Petroleum Processing

troleum Refining • Petrochemical Manufacturing • Gas Liquids Recovery DECEMBER, 1956

Merry Christmas – *from the Boys in the Bull Pen*

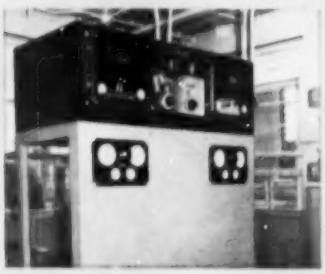
ALL PRODUCTS UP—that's your forecast for 1957 . . . p. 35
METALS IN THE REFINERY—advice for corrosion fighters . p. 52
SEVEN IDEAS for licking high pressure equipment problems p. 63

A McGRAW-HILL PUBLICATION
PRICE 35 CENTS

TECHNICAL DATA

The Sinclair Refining Company's Plant in Hartford, Illinois is equipped with the Proportioneers TC-CRP, Type 500-45 Two Component Blender. It produces up to 500 barrels per hour of various asphalt cutbacks. The stream blender is arranged to blend an asphalt and diluent in a given predetermined ratio ranging from 90% asphalt and 10% diluent to 55% asphalt and 45% diluent. The diluents are naphtha for RC cutbacks and kerosene and distillates for MC and SC cutbacks. This system has a recirculation feature on each stream to allow a test run of the blender setting before actually blending products. It also has a Tally meter for presetting the required number of barrels needed in a batch and when the required batch is blended, the two streams return to recirculation.

Asphalt cutback stream blending at Sinclair Refining Company, Hartford, Illinois.

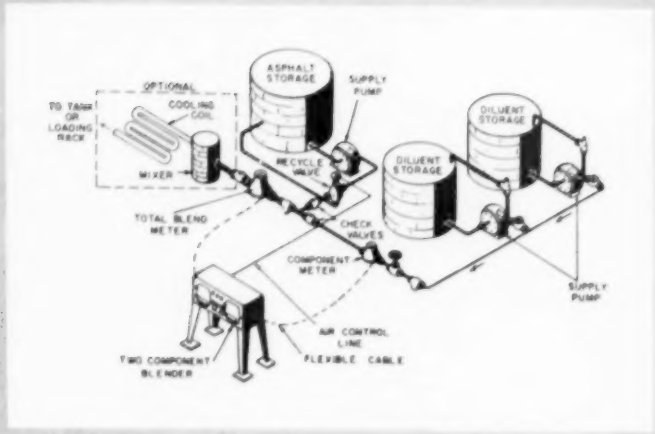


Close-up view of Model TC-CRP unit in control house shown above.

The stream blender uses positive displacement meters for measuring the two base products and the blended product. The meters give exceptionally high accuracy and very fine control over the entire range of asphalt cutbacks.

The system is equipped with remote stop and start positions at both tank truck and tank car loading racks. This feature makes it possible for one man to operate the blending plant and to do all the required loading.

"STREAM BLEND" ASPHALTS FOR STREAMLINED HIGHWAYS



THE PROBLEM:

Manufacturers of road oils and asphalt cutbacks recognize the blending of asphalt and cutter stock in open or vented tanks as a potential fire hazard. The present method of batch mixing an RC cutback by the addition of cold naphtha to hot asphalt results in high evaporation losses . . . while subsequent mechanical agitation produces an end product which requires reblending to produce the desired end viscosity. Material and time losses result. This is also true in MC and SC production, but to a lesser extent. The number of reblends required to produce the end viscosity depends entirely on the skill and experience of the operator.

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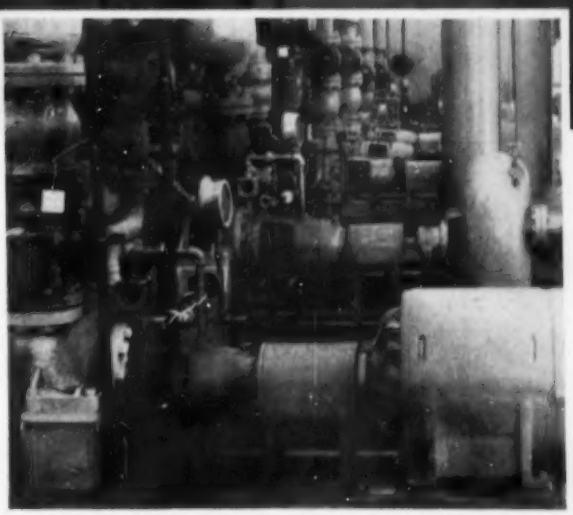

A few of the 20 Wilson-Snyder Type ES Centrifugal Process Pumps which handle the various combinations of capacities, differential heads, specific gravities and temperatures involved in this installation. Wide interchangeability of parts results in minimum inventory requirements.

NEW CONSTRUCTION involves problems of procurement and expediting, as well as design and erection. But American Liberty Oil Company, Mt. Pleasant, Texas, avoided all this when they modernized their 5,000 b/d thermal cracking facilities and added a new 6,000 b/d catalytic cracking unit.

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Reader's Guide to What's New in Petroleum

ANNUAL FORECAST

All Products Up in 1957

PETROLEUM PROCESSING's annual forecast shows a bright year ahead for the petroleum processor, but one with shifting product ratios. Total U.S. demand will hit 9,664,000 b/d average, which is 4.6% above the anticipated total for this year.

This is your annual outlook for the coming year, as prepared by Virgil B. Guthrie in a round-up of opinion from the industry's leading economists. **p. 35**

I III 2 3 5

Here's a Tricky Switch that Worked

Could you change cooling towers in mid-stream with no shutdown of processes or water flow? Warren Petroleum did it, and Southwestern Editor Ron Cannon tells how they did it in a helpful story in words and picture form. **p. 40**

III 3 4

THIS MONTH'S M&C

Decentralized Maintenance?

It might be the answer to your problems? It helped National Petro-chemicals Co. cut costs and avoid a manpower shortage. The whole story as told by National's chief engineer, C. D. Carnes. **p. 44**

II 4

Conventional but BIG

No matter how you look at it, the new 300,000 MCFD San Juan gasoline plant Pacific Northwest Pipe Line Co. has just completed in Colorado is a giant. Here's a first-hand description by Ron Cannon, your Southwestern Editor. **p .48**

III 2 3 4 5

Faster Tank Fire Fighting

A novel and useful idea Shell had for getting foam into storage tanks in a hurry. You use a portable tower with a sharply-pointed nozzle which pierces a plastic "window" over a rectangular opening atop the tank, and you're in business. **p. 51**

I 2 3 5

Choose the Right Metals

The "miracle material" is yet to be found, but if corrosion is your headache, here is some solid help by J. J. B. Rutherford, who presents a "rogue's gallery" of some equipment pieces guilty of chemical or mechanical failures. **p. 52**

I 2 3 4

Phase Studies Your Problem?

This new equilibrium test apparatus may help. It can handle such problems as PVT measurements, partial miscibility in a binary system, solid solubility, and the like. By Fred Kurata and James P. Kohn. **p. 57**

I II III 1 2

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Processing for December, 1956

I II III 1 2 3 4 5

Seven Ideas for Better Design

. . . of high pressure process equipment, particularly in the 10,000 to 20,000 psi range. The information is based mainly on experience in designing, engineering, and building ammonia-from-petroleum hydrocarbon plants. **p. 63**

II 2 3

Run a Pump Backwards?

Why not? There are several schemes for doing it that will give you a useful hydraulic drive unit. It's a technique natural gasoline plant men are developing more and more interest in, but it can work in almost any type of plant. **p. 67**

III 2 3

The Old Man Saves Christmas

This month the Bull Pen tells of the bad time the boys were having with a caustic tower. It looked for a while like it would ruin their Christmas Eve, but as usual, the Old Man had an idea for solving the problem and saved the day. **p. 83**

I II III 1 2 3 4 5

Your Annual Index

Bound within the covers of this issue you will find the Annual Index—1956, listing all feature articles and all regular departments in each issue for the twelve months of the past year. If you need extra copies, write the Editor. **p. 155**

I II III 1 2 3 4 5

I II III 1 2 3 4 5

Significant Ideas for Tomorrow

. . . as interpreted by the editors of PETROLEUM PROCESSING. This month's department includes: growth in aluminum as a material of construction; ultrasonics as an aid to maintenance; radioactivity's role in the near future. **p. 15**

I II III 1 2 3 4 5

Not So — says Los Angeles

Letters to the Editor this month turned up a different viewpoint from the accepted figure of 3% of all petroleum being lost by evaporation. Western Oil & Gas Ass'n. vice president Chapellet says this is simply not so in Los Angeles. **p. 19**

I 5

COMING NEXT YEAR

Watch those Future Issues

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Articles scheduled for near future issues will cover these subjects:

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- Selecting instruments for use in high pressure process services.
- Another special editorial report; this one on a piece of every-day equipment.
- A new series of articles aimed at helping you better your own career.

DEPARTMENTS

Advertisers' Index 114
Bull Pen 83
Editorials 148
Engineering Data Sheet. 87
Equipment —
What's New! 117
Information Offered ...112
Letters 19
Meetings for Oil Men ..107
New Words 85
Operating Trends 189
Patents 99
Personals 91
Plant Practices 79
Process Data Sheet 75
Publisher's Page 7
Readers' Service Card ..115
Statistics 109
Suppliers' News 95
Tomorrow 15
What's Happening 9
What's New! 117

Continue "Readers' Guide" on p. 71

HOW TO USE IT:

Your new "Reader's Guide to What's New in PETROLEUM PROCESSING" will do two things for you. First, the key numbers with each article will tell you at a glance if it is within your scope of interest; Roman Numerals indicate industries; Arabic Numerals, fields of activity. Second, the longer descriptions will tell you what each article is about, and why it can be of help and interest to you —THE EDITORS

Advertisement

Tracing the path of fuel with carbon-14

Ethyl Research tags 1 in 100,000,000 atoms with radioactive carbon for a better picture of distribution in the cylinders.

by D. E. COOPER
Ethyl Corporation, Detroit, Mich.

The distribution of fuel components and fuel additives to the cylinders of multicylinder engines is of prime importance to the petroleum industry. Just as a chain is only as strong as its weakest link, so is an engine's performance limited by the one cylinder which does not continuously get its proper dosage of high-octane hydrocarbons or of tetraethyllead.

The goal of engine designers is the creation of an engine wherein the fuel/air ratio, hydrocarbon composition and additive concentrations are identical for each cylinder of a multicylinder engine. Fuel injection—now becoming commercially available—represents one approach to the solution of this difficult problem.

Whether fuel injection or carburetion is employed, however, an accurate knowledge of fuel and additive distribution in engines is necessary to assure optimum use of the gasolines the refiner is producing today.

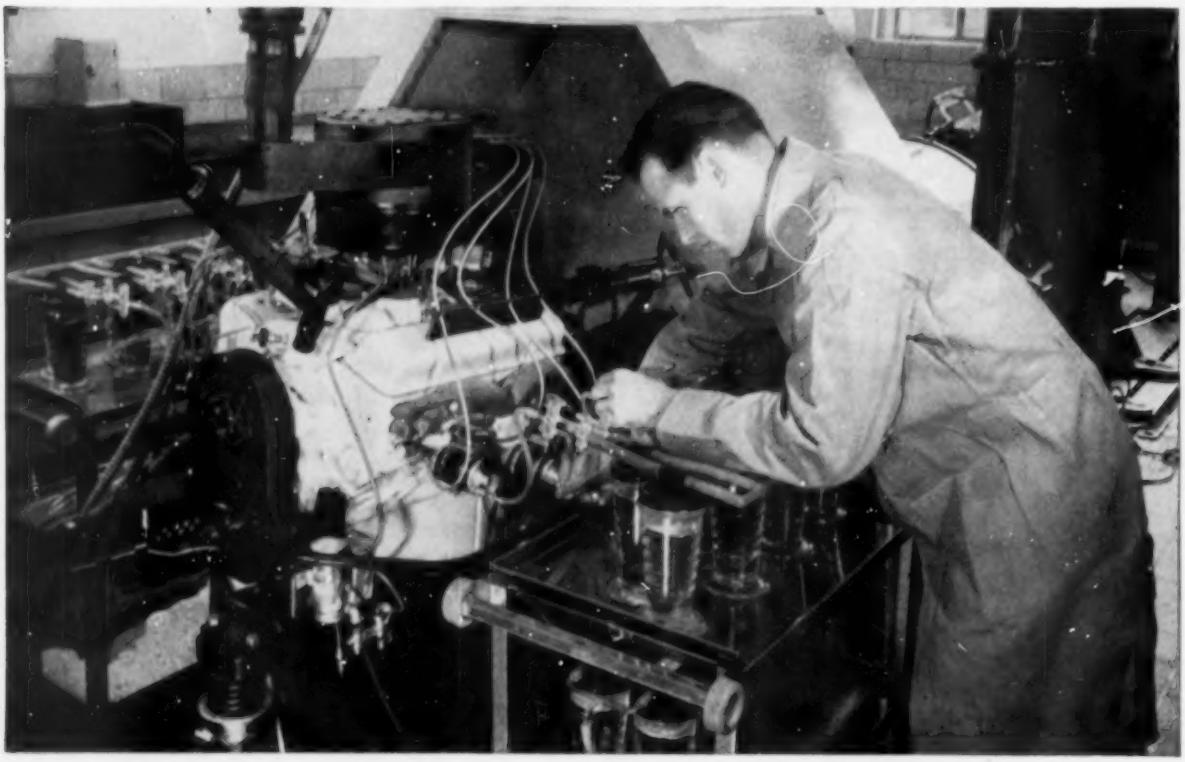
A continuing study

As is the case with most of Ethyl's other basic research studies, the study of fuel distribution has been a continuing one. Some years ago, a glass manifold was installed on an engine and motion pictures were made of flow patterns, giving some insight into the quantities of fuel mixture fed to various cylinders.

A second step in Ethyl fuel distribution studies involved the tagging of specific hydrocarbons with deuterium or heavy hydrogen. One component (the cyclopentanes, for example) had a specific number of hydrogen atoms replaced with heavy hydrogen. This special fuel was then burned in the engine. Samples of the exhaust gases from various cylinders were condensed and analyzed in a mass spectrometer to give a picture of the distribution of that particular

FIGURE 1. Nose view of combined sampling valve and spark plug.

FIGURE 2. Test engine in the laboratory and gas sampling and collecting system.



(To obtain more data on advertised products see page 114)

FIGURE 3. Scintillation counter setup at Ethyl Research Laboratories for examining tritium-containing condensate samples.

hydrocarbon among the cylinders of the engine on test. This technique required, however, that the ratio of heavy hydrogen to normal hydrogen be at least 1 to 100 and thus ruled out studies of additive concentrations, which are much smaller.

Tagged carbon atoms

A third step in this continuing program of fuel distribution studies has involved switching from a stable isotope such as deuterium to a radioactive one such as carbon-14. Now it becomes possible to tag tetraethyllead with carbon-14 and measure its concentration in an engine cylinder accurately, even though only one tagged atom is present among 100,000,000 normal carbon-12 atoms!

All of these distribution studies involved the use of a quick-opening (1 1,000 second) sampling valve. This valve samples the contents of a particular cylinder. It is screwed into the spark-plug opening and combines the sampling valve with spark-plug electrodes. Figure 1 shows a nose view of this combined sampling valve and spark plug.

Figure 2 shows the test engine in the laboratory and the gas sampling and collecting system. The gas samples are bubbled through absorbing solutions of barium hydroxide. The carbon dioxide is regenerated and transferred to an ionization chamber, where its beta activity is measured by a vibrating-reed electrometer.

And now . . . tritium

The newest refinement in this study consists of the replacement of carbon-14 with hydrogen-3 or tritium as the radioactive tracer element. The use of tritium simplifies and makes less expensive the preparation of tagged hydrocarbon or additive molecules for study. It also simplifies the exhaust-gas-sample collection technique. The scintillation counter used for studying the tritium-containing condensate samples from the cylinders is shown in Figure 3.

As is the case with all of our basic research studies, the information from this continuing study of fuel distribution is available to the petroleum industry. We would be happy to discuss any particular aspect of this problem with you in your office. We would also be happy to have you visit our Detroit Laboratories to see this equipment and discuss it with our technical personnel. In either case, contact your local Ethyl representative for an appointment.

What Ethyl Research offers you

Ethyl Research is in the unique position of serving both the petroleum and automotive industries.

In that capacity, we have contributed much in the field of fundamental as well as applied research. Today at our laboratories in Detroit we are conducting studies on the distribution of fuel components and fuel additives to the cylinders of multicylinder engines.

Searching for answers to these basic problems has led us to develop many new instruments and new techniques. The information which we have developed from our research efforts is being constantly circulated throughout both the automotive and petroleum industries to help them with their research.

If you desire any information concerning fuel-engine problems, just contact your Ethyl representative.

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There's No Better Way to Say It

EVERYWHERE we turn today we see signs of Christmas—in the shop windows, on the street, around the houses, and even in the plant. In a few weeks most of us in the petroleum processing industry will take a day off to celebrate the holiday.

Unfortunately, a processing operation can't be turned off and on as simply as you close up an office. Some of you, therefore, will still have to work on that day.

But perhaps you who are in that position will be nearer to the true spirit of Christmas. The plant will be sort of coasting along. There'll be the usual roaring furnaces, the hissing steam, and the gurgling liquids—but those noises will be a little more subdued, a little less frantic. And you'll have time to reflect on why we celebrate Christmas, and what it should mean to all of us—without interference from the glitter and tinsel and gayety that all too often get the spotlight.

We wanted to do something about Christmas in this issue that would typify this simple approach. And the most appropriate way we could think of to do it was to give you a glimpse of how the boys in our "Bull Pen" have been fixing up their place, of how they've been getting into the spirit of things.

We did it—on this month's front cover. If you didn't get a good look at it when you opened this issue, why not turn back and give it another look. And then, to find out how the Bull Pen gang almost spent Christmas, read this month's story on pg. 83.

In the meantime, we can't think of any better way to express our feelings than to say "Merry Christmas and Happy New Year" to all of you—from the Boys in the Bull Pen and the Editors of PETROLEUM PROCESSING.

William F. Bland

—Editor

P.S. One last thought: What is more proper than to end the year with a summary of what we've done. So the very last thing you'll find in this issue is our Annual Index for 1956—complete and up-to-date. If you'd like a reprint of this index for your files, we'll be glad to send you one. No charge; just circle number 100 in area "A" of this month's Reader Service Card, pp. 115-116. —WFB

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National Petroleum News
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how to keep a

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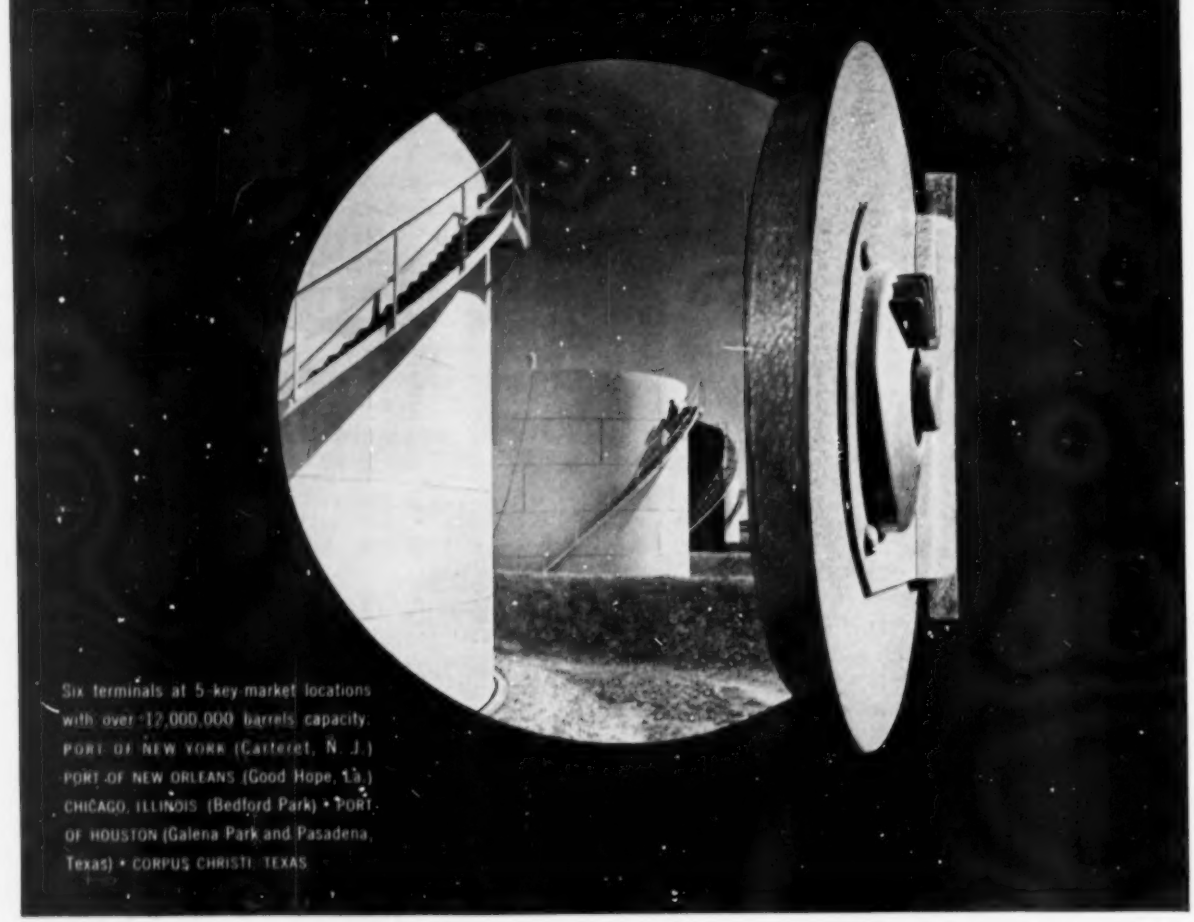

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What's Happening

in Refining

. . . **The outlook is good for 1957's** refinery product demand, pushing up to 9,665,000 b/d—a 4.6% increase over current estimated demand for 1956.

Jet fuel demand will be up 18.6% (mostly military) in 1957, gasoline demand up 4.8%, domestic distillate fuels up 6%. Residual fuel oil needs will rise less than 2%, and demands for kerosine and lube oils will remain about the same.

Marketing of premium gasolines will trend toward two premium grades, cheaper than upgrading the total premium pool to 100+ octane.

These are some of the conclusions in PETROLEUM PROCESSING's annual sizeup of the coming year's petroleum requirements (appearing in this issue on pp 35-39).

. . . **American Oil Co.** has awarded Ralph M. Parsons Co. the contract to build its 21,000 b/d combination hydrodesulfurization-Ultraforming unit.

. . . **Anderson-Prichard Oil Corp.** will expand its Arkansas City, Kans., refinery by 5000 b/d. It will build a 25,000 b/d crude unit, replacing existing capacity, and the cat cracker will be expanded by 2500 b/d, to a total capacity of 7500 b/d.

. . . **Big Horn Refining Co.,** newly organized by Wyoming, Montana and eastern businessmen, has leased Ohio Oil's Lovell, Wyo., refinery. Though presently leasing the refinery (closed by Ohio Oil a year ago), ultimate purchase is planned.

. . . **British Petroleum Co. Ltd.** has teams from England studying possibilities of BP's activities in eastern Canada, presumably both marketing and refining.

. . . **D-X Sunray Oil Co.** has signed a $10-million contract with Refinery Engineering Co. for six new units. Sunray's West Tulsa, Okla., refinery will have a 20,000 b/d Unifiner, a 12,000 b/d Platformer with rerun column, a 1417 b/d LPG recovery unit, a 2453 b/d butane isomerization unit and a 2470 b/d HF alkylation unit with debutanizer and rerun column. A 6000 b/d Unifiner will be built at the Sunray Village, Okla., refinery. Completion of all units is scheduled for late 1957.

. . . **Fluor Corp. Ltd.** is expanding its operations to include contract research in the petroleum, chemical and petrochemical fields.

. . . **General Petroleum Corp.** plans to spend about $7-million in next few years to increase capacity of its Ferndale, Wash., refinery from 35,000 to 48,000 b/d.

. . . **Industrial Asphalt Co.** will install four asphalt plants at various locations at a total cost of $600,000.

. . . **Phillips Petroleum Co.** has named Procon, Inc. to build a 3000 b/d combined feed fluid catalytic cracking unit at Phillips' Great Falls, Mont., refinery. Completion is scheduled for spring 1957.

. . . **Premier Oil Refining Co.** of Texas has awarded contract to Procon, Inc. to engineer and build a 1500 b/d combination Unifiner-Platformer at Premier's Longview, Texas, refinery. Completion is scheduled for April, 1957.

. . . **Queen City Refining Co.** plans to reopen its 2500 b/d refinery at Dickinson, N. D. The plant was closed last February for maintenance. Subsequently the company was reorganized.

. . . **Shell Oil Co. of Canada** is considering the prospect of building a refinery at Bronte, on Lake Ontario, some 25 miles southwest of Toronto.

. . . **Socony Mobil Oil Co., Inc.** has awarded J. F. Pritchard & Co. contract to build 3250 b/d catalytic reformer and 3000 b/d hydrodesulfurizer at Socony's Casper, Wyo., refinery. Completion is scheduled by fall 1957.

. . . **Standard Oil Co. (Ohio)** plans to spend $40-million for a new 60,000 b/d refining facility at its Toledo, Ohio, refinery, giving a net increase of 32,000 b/d over present capacity. The new facility will have atmospheric and vacuum crude distillation; delayed coking; catalytic cracking, polymerization, and reforming; hydrogenation, gasoline recovery and stabilization, treating and continuous gasoline blending and steam generation.

. . . **Texas City Refining, Inc.** will have Catalytic Construction Co. install a 7000 b/d Houdriformer at the former's Texas City, Texas, refinery. Onstream operation is scheduled in about 10 months.

. . . **The Texas Co. has** two expansion projects at its Port Arthur, Tex., refinery, including a 90,000 b/d fluid catalytic cracker and an 80,000 b/d vacuum pipe still. The cracker is due for completion early 1958, and the still will increase the refinery crude capacity 20,000 b/d, up to a total of 250,000.

. . . **Tidewater Oil Co.** has started operation of the 130,000 b/d crude unit at its new Delaware City, Del., refinery. The 10 other major processing units in the refinery will be placed onstream as each is completed late this year and early in 1957.

. . . **Fast tax write-off delays** on small refiners' applications, held up by the "dispersal" rule, may now be eligible under a new ruling. New dispersal regulations exempt expansions less than 50% of present capacity and costing less than $5-million.

. . . **Other new construction projects,** indicated by recent fast tax write-off approvals, were:

- Ashland Oil & Refining Co., $1,900,000 for 6000 b/d catalytic reformer, Canton, Ohio.
- Ashland Oil & Refining Co., $2,000,000 for 6000 b/d catalytic reformer, Tonawanda, N. Y.
- Pan-Am Southern Corp., $3,200,000 for refining facilities at El Dorado, Ark.; and $3,000,000 for refining facilities at Destrahan, La.
- Socony Mobil Oil Co., Inc., $2,470,000 for 9000 b/d catalytic reformer at Trenton, Mich.

in Gas Liquids Recovery

. . . **Sunray Mid-Continent Oil Co.** will build and operate a new gasoline products plant near the community of Carney in Lincoln County, Okla. The plant will process 17½-million cubic feet of natural gas a day (principally from the East Victor field). Construction is by Tuloma Builders of Tulsa, with operations scheduled for April, 1957.

in Petrochemicals

. . . **Du Pont Co. has several expansion plans** in the works. It will build a plant at Waynesboro, Va., to make 40-million lb/yr Orlon acrylic staple; one at Circleville, O., to double Mylar polyester film capacity; plans a 30-million lb/yr boost in cellophane capacity at Clinton, Ia.; has started engineering on a new unit to increase metallic sodium capacity 50% at Memphis, Tenn.

. . . **Apache Powder Co.** plans to build a 30 t/d ammonia unit at Benson, Arizona.

. . . **Carbide & Carbon Chemicals Co.** has spent $2-million more on air pollution equipment for its new Torrance, Calif., ethylene-chemical plant than normally would be needed for such a plant.

. . . **Celanese Corp. of America** has started building a new trimethylolpropane unit at its Chemcel Plant in Bishop, Texas. Completion is scheduled for late 1957.

. . . **Chemical Construction Corp.** has expanded its engineering design and construction services, and will now undertake projects in both the petrochemical and chemical processing industries.

. . . **Chemstrand Corp.** will more than double present nylon capacity at Pensacola, Fla., bringing production to 114-million lb/yr. Completion is scheduled for 1958. First step—to 88-million lb/yr—will cost $43-million.

. . . **Commercial Solvents Corp. and Columbia Gas Systems, Inc.** are studying a proposed joint $40-50-million petrochemical venture for the Ohio Valley. Plans are for construction to start early 1957.

. . . **Humble Oil & Refining Co.** will soon start building a 24-million gal/yr benzene unit at its Baytown, Tex., refinery. Completion is due late 1957.

. . . **Jefferson Chemical Co.** reportedly plans a $38-million expansion at its Port Neches, Tex., plant; it will produce chlorine, caustic soda, ethylene and ethylene oxide, among other materials.

. . . **Jefferson Lake Sulphur Co.** plans a $3.5-million petrochemical plant. It's looking for a site along the Houston, Texas, Ship Channel.

. . . **Odessa Styrene Co.,** a newly formed company owned 75% by El Paso Natural Gas and 25% by United Carbon Co., will start construction the first of 1957 on a $5-million styrene plant near Odessa, Tex., the last part of a major synthetic-rubber manufacturing facility.

. . . **Reichhold Chemicals, Inc.** will build two 35-million lb/yr formaldehyde plants, one each at Detroit, Mich., and Tuscaloosa, Ala. At Tuscaloosa, pentaerythritol production will be increased from 4-million to 10-million lb/yr, and phenol production will be increased 50% to 75-million lb/yr.

. . . **Union Carbide and Carbon Corp. and Publicker Industries, Inc.** have bid for leasing the government-owned alcohol butadiene plant at Louisville, Ky. Bidding opportunities will end Dec. 15. The plant is now under 3-year lease to Publicker, ending April 4, 1958.

. . . **Union Oil Co. of Calif.** has started building a 100-million lb/yr ethylene unit at its Los Angeles refinery. Work is to be completed early 1958. Most of the ethylene output will be pipelined to the Brea Chemicals-Koppers Co. polyethylene venture.

in Foreign Operations

. . . **Britain and Europe**

Imperial Chemical Industries Ltd. continues expanding at its Wilton works in North Yorkshire (see PETROLEUM PROCESSING, Aug., 1956, p 10) announcing that a second ethylene glycol plant (boosting production at Wilton to 32-million lb/yr) will be built, scheduled to go onstream early 1959.

British Geon, subsidiary of Distillers Co. Ltd., is building a synthetic rubber plant in Glamorganshire. Product will be butadiene-acrylonitrile copolymers.

C. F. Braun has the contract for general engineering of a 20,000 t/yr butyl rubber plant to be built in France by Societé du Caoutchouc Butyl.

Danger... Corrosion at work!

ABOUT THIS PHOTOGRAPH—In capturing this closeup of corroded "coupons" and a distance shot of a refinery on the same negative, well-known photographer Bernard Hoffman achieved amazing depth of focus. Using revolutionary techniques which he has pioneered, Mr. Hoffman is able to achieve over-all sharpness of near and far objects; long the goal of photographers.

Internal refinery corrosion, as measured by these badly corroded coupons, is becoming a thing of the past where Polyrad inhibitor is used. Because Polyrad is a filming amine, it forms a molecular film that protects metal from attack. And Polyrad's detergent action aids in keeping the metal surfaces clean, thereby maintaining heat transfer and operation at unit capacity.

Polyrad is available from stocks maintained throughout the country. We'll be glad to tell you how to protect your refinery with Polyrad.

POLYRAD®

FILMING AMINE INHIBITOR

Pine Chemicals Division, Naval Stores Department **HERCULES POWDER COMPANY** *984 King St., Wilmington 99, Del.*

Houilleres de Bassin de Lorraine (French firm) is planning a styrene monomer plant based on processes and know-how supplied by Koppers Co. Societé Belge de L'Azote will engineer the project.

Ireland may have more refining capacity in addition to the Caltex, Esso, Shell-Mex, B. P. project already announced in County Cork, Erie (see PETROLEUM PROCESSING, Aug., 1956, p. 10). The Minister of Commerce in Belfast is on record as favoring a refinery in northern Ireland if any proposals with reasonable prospects of success are forthcoming.

. . . Latin America

Creole Petroleum Corp.'s expansion plans at its Amuay Bay, Venezuela, refinery (see PETROLEUM PROCESSING, Nov., 1956, p 12) will include an Esso Lube Hydrofiner, a 75,000 b/d single-stage crude distillation unit, a 17,000 b/d Hydrofiner for diesel oil, a phenol extraction unit, a propane dewaxing plant and complete blending, canning and packaging facilities for lubes. These units will be designed and built by Foster Wheeler Corp.

Petroquímica Cubana, S. A., plans to start construction on first units of a $10-million petrochemical plant at Santiago de Cuba before the end of this year. First unit will be $2-million unit for caustic soda, chlorine and hydrogen. Seven years will be needed for the entire project.

. . . the East

The Japanese Government wants three companies, Sanyo Chemical, Mitsubishi Petro-Chemical Co. and Yokohama Rubber Mfg. Co., to merge for the production of 30,000 t/yr synthetic rubber. The Government feels that the three separate plants proposed by these companies would be uneconomically small.

Burmah-Shell has agreed to draw up plans for a 20,000 b/d refinery at Karachi, as requested by the Pakistan government.

Iraq's Development Board plans a 300 t/d sulfur plant near Baghdad, using natural gas as a raw material. A by-product from the sulfur plant will be 1000 b/d of mixed gasoline, butane and propane. Estimated cost is $5.6-million.

Jordan Government says that firms of 12 countries, including the Soviet Union and Czechoslovakia, have shown interest in Jordon's projected 6000 b/d, $11,400,000 refinery at Al-Zarkaa. This will be Jordan's first refinery.

Furukawa Industrial Co. is a newly formed Japanese company planning to make polyethylene (using Standard Oil Co. of Indiana's process) and acrylic fiber. The plant will be finished in 1957 with a rated capacity of 20-million lb/yr polyethylene.

in Markets and Prices

. . . Middle East crisis added further strength to fuel oil markets in most primary districts last month. Prices rose at the Gulf, and this coupled with soaring tanker market killed off discount offerings in the East. Earlier increases on light fuels in middle Atlantic states spread to the Southeast, and prices also moved up in the Midwest.

. . . Gasoline remained shaky, reflecting the oversupply position, and widescale reductions occurred in large areas. Middle East inspired "feeler" inquiries began to appear, however, and trade observers read into this a possible step toward working down high U. S. inventories.

Low cargo quotations for gasoline at the Gulf were trimmed by 0.25¢ to 0.625¢ gal, with larger cuts being made on lower octane grades. Tank wagon reductions were made in 20 states.

. . . Some grades of light fuels at the Gulf advanced 0.25¢ gal, while heavy fuels rose 25¢ bbl. Residual fuel suddenly became a precious item as spot sellers pulled out of the market and there was increasing talk of price advances. A Gulf Coast buyer sopped up 600,000 bbl of No. 6 fuel in the Mid-Continent—at delivered-Gulf price of $2.635 bbl. This compares with nominal quotations ranging upward from $2.15 bbl, FOB Gulf.

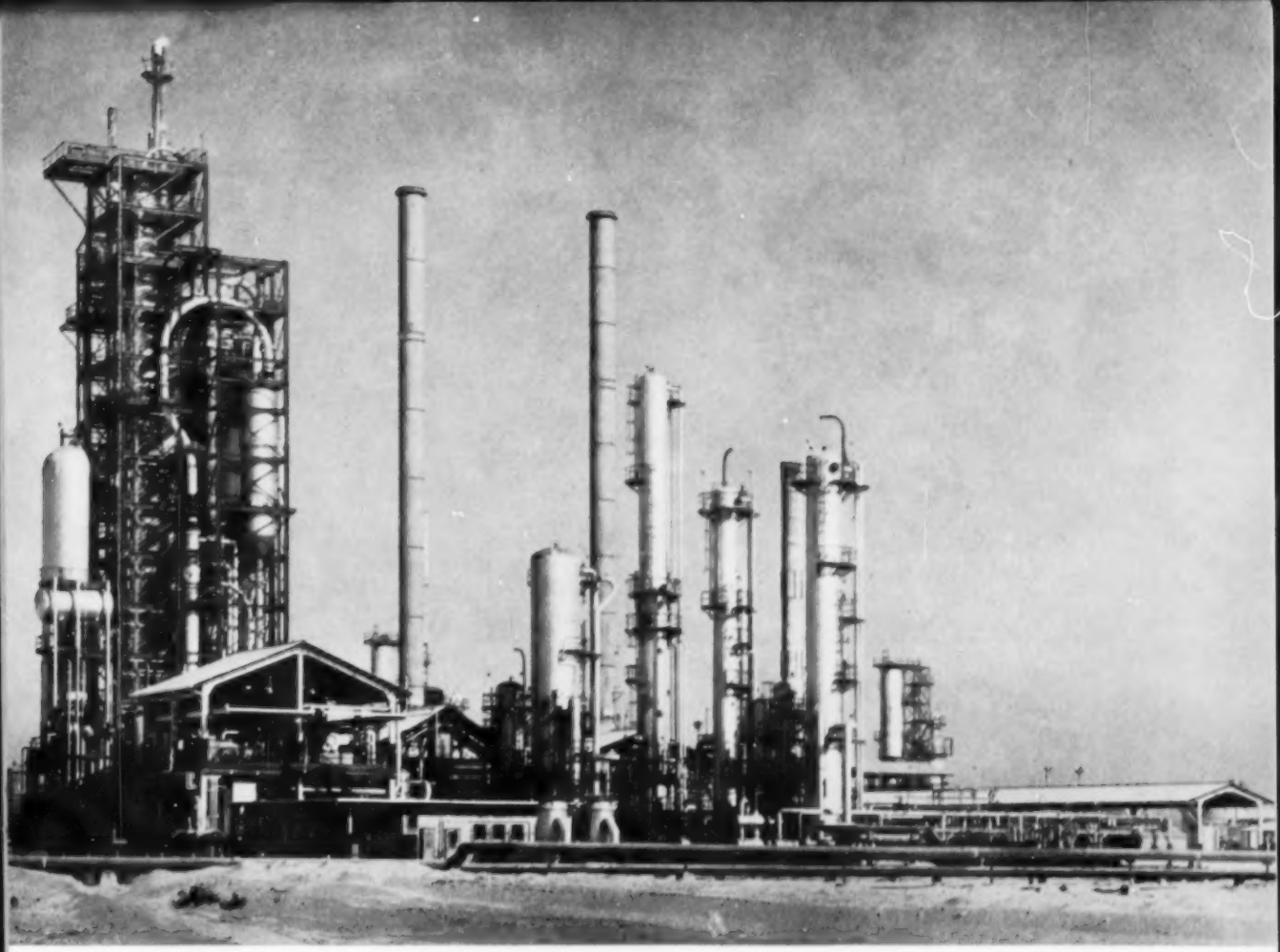
. . . Other major price developments last month included 0.5¢ gal reduction in natural gasoline prices, both FOB Group 3 and Breckenridge basis; extension of propane price advances in Mid-Continent to East and Southeast; and general 0.25¢ lb advance in Pennsylvania petrolatums prices.

Looking Ahead

. . . Petrochemical production may increase to 20 times the current rate by 1975, according to Carl A. Gerstacker, vice-president, treasurer, and a director of Dow Chemical Co. while speaking at the Dallas, Tex., meeting of the Independent Petroleum Assn. of America. One likely target for expansion is in the plastics markets for making plastic laminate bodies for automobiles.

. . . Standard Oil Co. (Ohio) will start research to develop commercial processing of an oil sands reserve near Vernal, Utah, containing an estimated total of 1-billion bbl of oil. Sohio Petroleum Co. will do the actual work, budgeted at "several million dollars."

. . . Alberta's tar sands may be used earlier than expected as a result of the Suez Canal crisis. There is an estimated 300-billion bbl of oil in these sands. Two Canadian companies with leading roles in development planning are Royalite and Can-Amera.



Lummus, Aramco teamwork supplies more quality gasoline from Saudi Arabia

In August at Ras Tanura, Saudi Arabia, a 12,500 B/D Fluid Hydroformer is undergoing its first turnaround since it came on stream in October, 1955. For the past 10 months this unit has supplied 92.5 F-1 clear octane blending stock to European and Middle East markets, where the need for quality gasoline is growing rapidly.

The Hydroformer was designed and engineered by Lummus for The Arabian American Oil Company under license from Esso Research and Engineering Co. The process, though more complex than any other in the Ras Tanura Refinery, was designed for ease of operation to fit in with the Company's policy of training and upgrading Saudi Arab nationals to the fullest extent.

Close liaison among the three groups during all phases of design and construction has paid off. Startup was smooth, with all facilities operating at full design rate soon after feed was introduced. And the plant has been operating successfully ever since, at and above the design rate. In all cases, hydroformates of premium quality have been obtained from the high paraffin – low naphthene stocks characteristic of Arabian crudes.

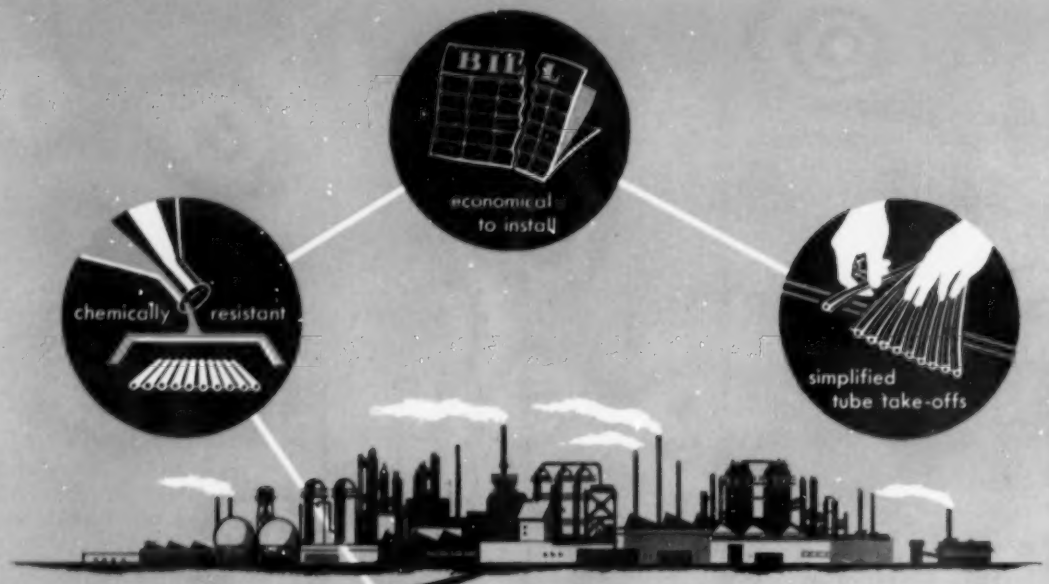
Test runs at feed rates of 12,500 – 16,300 B/D have yielded products of 94.8 – 87.4 F-1 clear octane. There has been no difficulty in making the 92.5 octane design product at rates up to about 13,500 B/D. These tests indicate that hydroformates close to 95 F-1 clear can be produced in good yields, and should higher quality be needed, more severe hydroforming conditions appear to be feasible.

Aramco's new Hydroformer is one of over 700 major Lummus installations throughout the world. The excellent operating record of this new unit, and of Lummus plants in general, proves the case for coordinated direction of a project from idea to startup. Lummus teamwork can pay off on your next project.

THE LUMMUS COMPANY, 385 Madison Avenue, New York 17, N. Y. *Engineering and Sales Offices:* New York, Houston, Montreal, London, Paris, The Hague, Bombay. *Sales Offices:* Chicago, Caracas. *Heat Exchanger Plant:* Honesdale, Pa. *Fabricated Piping Plant:* East Chicago, Indiana. *Engineering Development Center:* Newark, New Jersey.

LUMMUS

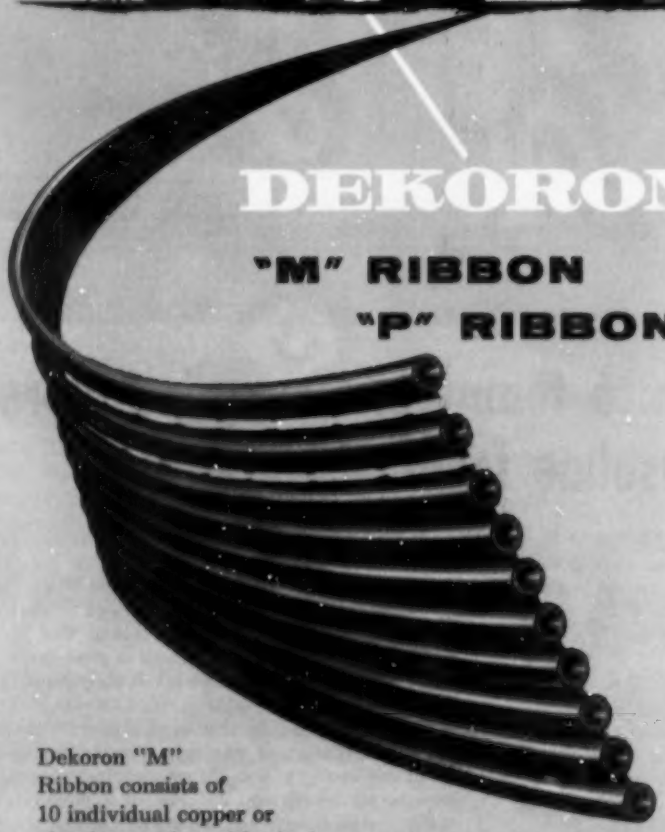
ENGINEERS AND CONSTRUCTORS FOR INDUSTRY



the great new flat multiple-tube instrument line harness

DEKORON

"M" RIBBON
"P" RIBBON



Dekoron "M" Ribbon or "P" Ribbon makes instrument tubing costs plummet. That's because the chemical resistance of the plastic sheath even outlasts expensive alloy tubing . . . because you get all the advantages of bundle installation in a flat, easy-to-handle "ribbon" . . . because the perforated plastic "webs" between individual tubes enable tubes to be stripped back singly or in groups without tools and without destroying protective coating. So tube up with Dekoron "M" Ribbon or Dekoron "P" Ribbon —it's a "pipe" to install.

Dekoron "M" Ribbon consists of 10 individual copper or aluminum tubes with vinyl plastic coating; Dekoron "P" Ribbon is 10 polyethylene "P" tubes with vinyl sheath.

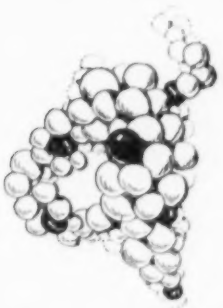
Dekoron® products
QUALITY • RESEARCH • SERVICE

SAMUEL MOORE & CO. • DEKORON PRODUCTS DIVISION • MANTUA, OHIO

Look to Solid State Physics for Tomorrow's Tools and Techniques

THE TRANSISTOR, so far the most important fruit of solid state physics research, is probably only the first of many new industrial tools to come from this tremendously promising field.

Coming into sight for petroleum processors are superconductors, intermetallics—chemical combinations of metals with strikingly new properties—sliver-thin batteries able to generate half a volt for 20 years and small enough to be regular instrument components, and impulse retaining crystals of barium titanate that promise much for computer technology.



A "field emission" microscope has now been developed that magnifies up to 50,000,000 times. Its first job will be catalyst study, to permit scientists to design their catalysts on the basis of observation of molecular structure and engineering calculation, with less reliance on trial-and-error. —A.C.

More Use of Aluminum Seen in Near Future Processing Plants

STEPPED-UP research to find new refinery uses for aluminum is in the works for all three major producers—Aluminum Co. of America, Kaiser Aluminum and Chemical Corp., and Reynolds Metal Co. These are sure signs that the metal will be increasing in use. One spokesman said that processing plant use of aluminum will really come into its own within the next 18 months.

Already established as an important material, aluminum is now being used in refineries for instrument tubing, electric transmission lines and busses, jacketing for insulation, heat-exchanger tubes, bubble caps, platforms and walkways, tank roofs, and piping to some extent. Many low-temperature processes are made possible by aluminum as an alloying element in aluminum-killed steel, which gives ductility and impact strength at sub-zero temperatures.

But, say aluminum men, the industry "ain't seen nothin' yet."

Among the many advantages that will appeal to refinery men are aluminum's light weight, corrosion resistance to most refinery fluids, non-sparking qualities, low cost, smooth pipe walls, and the fact that aluminum is not contaminating to most refinery products. All this means lower costs.

You can expect to see more aluminum in piping systems and flanged-pipe assemblies, and in pressure vessels—particularly if present efforts to assign pressure-temperature ratings to aluminum fittings are successful.

One report of test results on aluminum flange-pipe assemblies was presented at the ASME Petroleum Conference in Dallas, Texas, in September. Flange tests indicated that 6061-T6 aluminum welding-neck flanges are essentially equal in strength to carbon steel flanges of the same dimensions, and at sub-zero to atmospheric temperatures can be given the same ratings for carbon steel flanges at 100°F.

Troubles haven't disappeared, however. Aluminum has limitations, as does any other material. Its coefficient of expansion is about twice that of steel and it has a lower tensile strength than steel. Although the material has good low temperature properties, it is not suited for high-temperature work. The ASME paper indicated that short exposures to a temperature of 700°F reduces the tensile strength of 6061-T6 aluminum by approximately 50% so that welding procedures must be closely controlled. Some users of aluminum instrument tubing have met excessive corrosion when the line contacts a dissimilar metal, causing galvanic pitting.

A versatile new material is on its way.—R.E.C.

Will the Seller's Market for Technical Men Last Much Longer?

DOES last fall's record college enrollment of 3,200,000 mean there is an end in sight to the shortage of engineers and scientists? It depends on how good your sight is, according to a recent booklet by the National Science Foundation ("Trends in the Employment of Scientists and Engineers"). Certainly there are changes coming, but in the foreseeable future the best predictions show a rampaging demand continuing to outdistance the slowly growing supply of technical graduates.

The classes of 1954 and 1955 were the low points since 1950 in graduations of engineers. Now a marked recovery has begun, and when official

figures on last June's graduations are released they are expected to show a jump from 23,000 to 29,000 with B.S. degrees. Output of B.S. graduates in the natural sciences touched bottom only last June, and a slight rise is anticipated next June.

The biggest uncertainty about predictions beyond the next couple of years is the proportion of science and engineering graduates to all college graduates. For engineers this proportion dropped after 1951 from 10% to between 7 and 8% (where, incidentally, it stood from 1926 to 1940). Now there are signs it will turn upward again, perhaps to exceed 10%.

The decline of science's popularity among college students is of older origin, and it's too early to say whether this trend (which began in the 20's) has actually reversed itself. But if science recovers only the proportion of students it had before 1952 (12-13%), the great rise in the college population now beginning would alone bring a healthy increase in graduates. With these possibilities in mind, the NSF's conservative guess is that 51,000 engineers and 52,000 scientists will be graduated with B.S. degrees in 1965.

But remember, the important work in research is done by people at the Ph.D. level, not by B.S.-holders. Improvement in the number of doctoral graduates is not expected before 1959, and the best guess is that only 8,200 people will be graduated with a science or engineering Ph.D. in 1965 —not quite twice the size of last June's crop.

More important, while the supply of technical manpower is climbing, the demand won't be standing still. The Foundation expects steady growth in the economy to tighten any slack the new men create. By 1970, they say, the number of engineering jobs will have doubled, and research and development expenditures may be $8.1 billion rather than today's $5.5 billion. If anything the figure for R&D is conservative, and some—Esso Research & Engineering's Duer Reeves for instance—believe it will be considerably higher, perhaps $12 billion by that date.

An important change in the manpower picture could come from the decision of more students to follow scientific or engineering careers. Right now this would be sharply limited by the acute shortage of elementary and high-school teachers and classrooms. But with a serious attack on this problem, higher salaries, public attention, and scholarship programs by interested parties may well boost the future proportion of technical students to now-unpredictable levels. —S.D.B.

Outlook Broadens for Uses of Atom in Petroleum Processing

THE IDEA that radioisotope tracers will soon be major tools for routine "bread-and-butter" technical services in the refinery is being received with cautious optimism.

U.S. industry saved an estimated $200-million in 1955 by using tracer techniques. About 10% of this was by the petroleum industry. Some believe tracers will save industry $1-billion in 1960.

There are problems to be solved before atomic radiation can assume its full potential—namely education directed by management and public relations to show that the atom can be safe.

The above are a few of the conclusions reached at the Third Annual Symposium on Applications of Radioactivity, sponsored by Tracerlab, Inc. at Boston, Mass., in October.

Many major oil companies, as well as representatives of the Atomic Energy Commission and other interested persons, contributed to a series of talks and papers that covered nearly every phase of the atom in the refinery.

Routine applications of tracers in the refinery were described by D. E. Hull of California Research Corp., who concluded that an integral tracer group can easily earn its keep by solving day-to-day refinery problems.

Radiation processing to make benzene hexachloride (lindane), alkene-SO_2 polymers, and polyethylene was described by J. J. Martin of the Univ. of Mich. Mr. Martin indicated that such gamma-ray processing methods are almost of commercial feasibility.

To support his point, Mr. Martin presented process designs and cost estimates to show that the investment to manufacture 60-million lb/yr of gamma-ray processed polyethylene might be as low as $20-million, with operating costs (including overhead and amortization) as low as 27¢/lb. Firm estimates, however, cannot yet be made.

Management must take a leading role in educating employes, their families, and the public in the nature of radiation techniques, according to Mr. R. G. Gallagher of Liberty Mutual Insurance Co. Education precedes safety and good public relations, which in turn must exist if management expects reasonable insurance and liability costs.

If industry can prove that it can match the excellent safety record shown by the Atomic Energy Commission during the past 14 years, an important step will have been taken to remove the "hysteria" from reaction to a nearby atomic facility.—R.L.D.

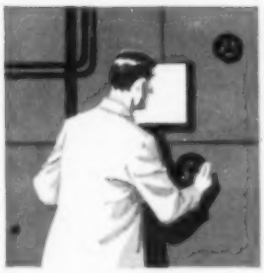
Our Lubrication Engineers worked with Engine Designers, then put

EXTRA anti-wear protection in AEROLUBE® 93-C!

Top anti-wear characteristics are specifically formulated into Cyanamid AEROLUBE 93-C inhibitor to give the extra protection required in engine break-in, severe service or other problem conditions faced by lubrication engineers. This concentrated zinc dithiophosphate inhibitor safeguards stability—it is an excellent oxidation inhibitor that prevents formation of harmful peroxides and organic acids. It sharply reduces wear of valve lifters and other critical engine parts.

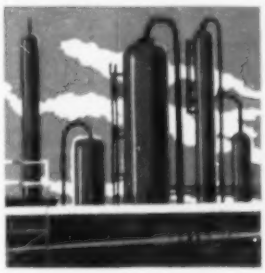
Zinc dithiophosphate has proved itself to be one of the most effective additives for commercial lube oils. Maximum wear resistance, oil stabilization and bearing protection, demanded by modern engines, have been built into Cyanamid's AEROLUBE 93-C.

Light color and compatibility with lube stocks and other additives, make AEROLUBE 93-C outstanding for use in premium oil products—for regular use as well as initial fill.



AERO® HDS CATALYST

In modern hydrodesulfurization processes, Cyanamid's new AERO HDS Catalyst contributes highest available volume activity and excellent mechanical properties. Cyanamid's specialized catalyst know-how may be helpful in initiating or improving your hydro-treating operation.



REFINING RESEARCH

At Stamford, Connecticut, the Refinery Chemicals Department of Cyanamid maintains laboratories unsurpassed in the refining field for basic research and development in catalysts and other refinery chemicals. As a part of extensive research and pilot plant facilities, specialized equipment and methods—such as the electron microscope and vapor-phase chromatography—are used to develop information leading to improved products which give optimum performance under field conditions.

Our field men are constantly absorbing new developments at the research, development and operating levels. In this way, your Cyanamid man keeps abreast of the petroleum industry's dynamic technology and can offer a valuable technical service to refiners.

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(To obtain more data on advertised products see page 114)

SK apades in industry

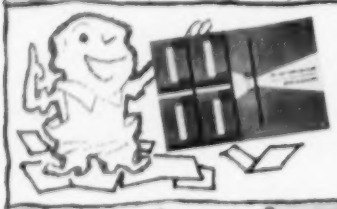
THE CASE OF THE PERIODIC PUMPING PROBLEM AND THE PATIENT PLANT ENGINEER

". . . ub glub bedubtub
(this situation's becoming impossible)," glubbled Barney, the patient plant engineer.

"Ub tub ud ub tub ud ub tub
(I've tried and I've tried and I've tried)," bubbled Shorty, his faithful, conscientious assistant,
"Bud dub pubs wud hubtub dub slubb
(But the pumps won't handle the sludge)—it ruins them every time."

"Wub, subtub's *gub* tub bub dub
(Well, something's *got* to be done)," answered Barney. "Or, *I'll* lose my *patience* AND YOU'LL LOSE . . . well, you'll be an *ex-faithful, ex-conscientious* assistant plant engineer."

With that, Shorty stubbled away . . . in the direction of his office and catalog files.

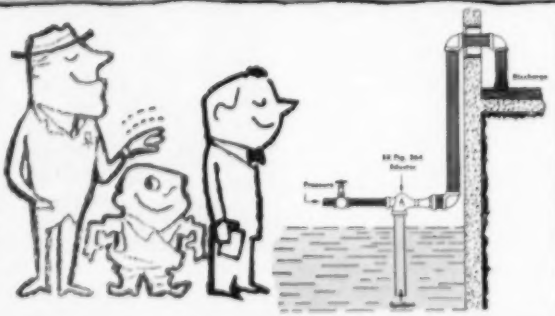


"I've got it," shouted Barney. "It says either an SK Jet Eductor or Syphon is good for pumping liquids where solids or semi-solids must pass through the apparatus and is ideal for use where pumping is periodic."

So he called in his nearest SK Sales Engineer who made an on-the-spot survey of the situation and, because of certain special considerations, recommended the use of an SK Fig. 264 Water Jet Eductor.

PATIENCE REWARDED

It paid to be patient. Now, the recurring drainage problem has been solved, simply and inexpensively. The SK Fig. 264 Water Jet Eductor uses pressure liquid, entering the eductor through a nozzle, to create a vacuum in the line which causes the suction liquid to flow up into the body of the eductor where it is entrained and discharged. Solids and semi-solids present no problem. Since there are no moving parts and the eductor is self-priming, the jet is ready to operate when required.



MORAL:

Get acquainted with all types of SK Jet Apparatus. Send for a copy of Condensed Bulletin J-1. Make use of a qualified specialist, your nearest SK Sales Engineer.

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VALVES: Ask for Condensed Bulletin V-1.
HEAT TRANSFER APPARATUS: Ask for Condensed Bulletin HT-1.
GEAR PUMPS: Ask for Bulletin 17-A.

Not So Says Los Angeles

To The Editor: In your Special Report on Evaporation Losses (July, 1956, pp. 103-126), you stated that about 3% of all petroleum produced in this country is lost by evaporation on its way from the well head to the consumer.

While we can speak only for conditions in Los Angeles County, we believe that your 3% figure may be 4 to 10 times too high for this area, despite the fact that Los Angeles County is a considerable producer of crude oil, an important refining center, and one of the largest markets for gasoline in the world.

Here is how we have come to this conclusion:

In Los Angeles County, the petroleum industry processes some 650,000 b/d of petroleum. Of the 650,000 bbl, approximately 220,000 b/d are actually produced in the county.

Were your 3% figure to apply, hydrocarbon vapor losses to the atmosphere here would represent something between 6,600 and 19,500 b/d (depending on whether you applied the 3% to production, refinery throughput, or consumption volumes).

Several audits have been made of the petroleum losses in the County of Los Angeles by Stanford Research Institute, the Western Oil and Gas Assn., Southwest Research Institute, and the Los Angeles County Air Pollution Control District. Time has shown a steady decline in the loss of hydrocarbon from the industry until it now amounts of about 200 ton/day.

The present Los Angeles ACPD estimate totals 231 ton/day for all the losses from production, refining, distribution, and shipping to the point of dropping into underground tanks of service stations. This is equivalent to less than 1700 b/d, a figure considerably less than the amount that would be derived from your average loss of 3% . . .

Stated differently, the loss in Los Angeles County is about 0.25% of refinery throughput.

The Los Angeles ACPD loss estimate given above is believed by some oil industry men to be too high. We use this figure to give you the most severe appraisal.

May we suggest that you carefully recheck the source of your information as to the "estimated 3%" statement in your article. We believe this is of utmost importance to the oil industry, for should this "3%" figure be accepted as valid—and we don't believe it should be—the oil industry could be subjected to excessively restrictive and wasteful regulations on hydrocarbon vapor loss control by air pollution control officials all over the nation.

Felix Chappellet
Vice President and
General Manager
Western Oil and Gas Assn.
Los Angeles, Calif.

● Thank you for your comments, Reader Chappellet. There is no doubt that the petroleum industry in the Los Angeles area has done a tremendous job in reducing air pollutants for which they were responsible. This is nowhere more evident than in the figures you give, in comparison to the national average loss of 3%.

That figure incidentally represents an average of figures submitted by oil companies in all sections of the country prior to a report presented to the Fourth World Petroleum Congress in Rome last year. And it was substantiated by other industry sources during the preparation of our report on Evaporation Losses earlier this year.

There are probably a number of sections of the country—Los Angeles being one—where evaporation losses are much less than the national average. This is evidence of intensive measures in controlling these losses. The fact that within the past four years the loss figure for Los Angeles County has been so thoroughly reduced is striking evidence that stringent measures can eliminate this unnecessary loss of one of our most valuable natural resources.

However, the exact determination of evaporation losses has been hampered by lack of accurate measuring methods. Even the figures used by the Los Angeles ACPD are not universally accepted. Until infallible methods for precise determination of losses become available, we will be forced to rely on careful estimates made by those in the oil industry closest to the problem.

The Editors

THE EDITORS

would like to hear from you. If you have any suggestions, comments, or criticisms, drop a note to:

The Editor
PETROLEUM PROCESSING
330 W. 42nd St.
New York 36, N. Y.

Foreign Synthetic Rubber

To The Editor: . . . It gave me great pleasure to read the article on synthetic rubber (Sept., '1956, pp. 98-106), and I would like to point out an addition you might have made to your survey of foreign plants.

Under construction in Italy is a plant for 35,000 metric tons of GR-S rubber. The butadiene will be produced by starting from natural gas, then through acetylene, acetaldehyde and alcohol. The know-how for the production of acetylene by partial oxidation of methane and for the synthesis of butadiene by reacting alcohol with acetaldehyde is being furnished by Union Carbide and Carbon Co.; and Phillips Petroleum Co. had designed the copolymerization step. The plant will be commissioned in the spring of 1958.

As to the German plant you mention (Chemische Werke Huels, 30,000 ton, in West Germany), it will not use alcohol for butadiene production, but rather butane by the Houdry dehydrogenation process.

G. Roberti
ANIC
Milano, Italy

● *Thank you, Reader Roberti. It was not our intention to make a complete tabulation and report on foreign synthetic rubber in this particular article. Your information will be of help and value to our readers in this country.*

Corrosion Pix Mix

To The Editor: We would like to thank Petroleum Processing for the excellent presentation given to our paper on pp. 64-68 of the October issue ("H_2S Corrosion in Sovaformers").

We have noted a rather serious error in this publication. The charts shown as Figs. 8 and 9 have been interchanged. For the correct arrangement you may want to refer to the American Petroleum Institute reprint of the paper. Thank you again for your interest in our work.

E. B. Backensto
Socony Mobil Oil Co., Inc.
Paulsboro, N.J.

Solvent Decarbonizing gets

MORE

OUT OF YOUR CAT CRACKER

Kellogg Solvent Decarbonizing helps refiners get more profitable products from their cat crackers because it squeezes more profitable feedstock from each barrel of crude processed.

Used as a supplement to vacuum distillation, Solvent Decarbonizing can recover 40 to 75 percent of valuable catalytic feed from residues which would otherwise go to fuel or thermal cracking.

Result: More and Higher Octane Gasoline, when and as required . . . More Light Olefins for alkylation, polymerization, petrochemicals . . . More Flexibility in meeting varying fuel oil and distillate demands. And, with all this . . . more relief from corrosion and fouling.

A detailed description of Solvent Decarbonizing and evidence of its strong economic position in the process scheme are given in Issue No. 3, 1956, of M. W. Kellogg's 16-page "Kelloggram".

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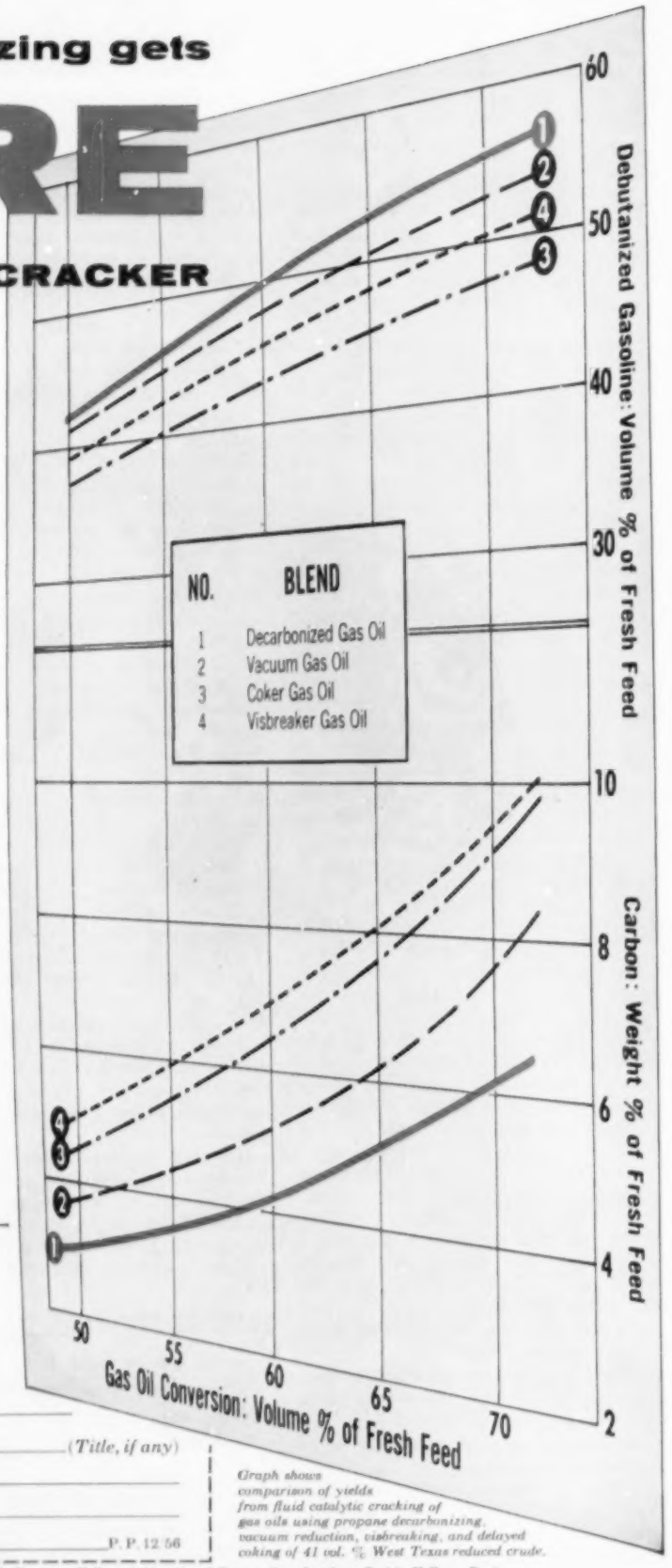
KELLOGG



Graph shows comparison of yields from fluid catalytic cracking of gas oils using propane decarbonizing, vacuum reduction, visbreaking, and delayed coking of 41 vol. % West Texas reduced crude.

Refinery Process Division
THE M. W. KELLOGG COMPANY
711 Third Avenue, New York 17, N. Y.

Send copy of your 16-page Kelloggram, describing Solvent Decarbonizing and its economic advantages.

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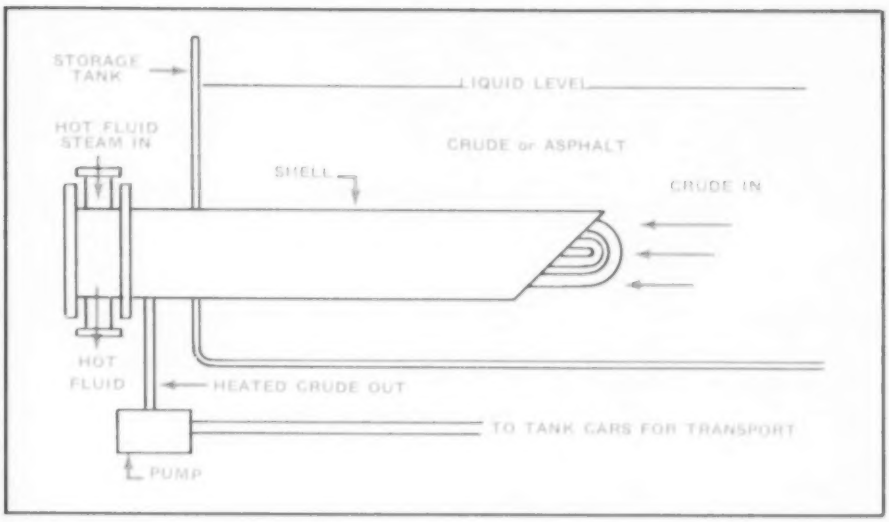
(To obtain more data on advertised products see page 114)

TEXANS SHOW HOW TO HURRY CRUDE FROM STORAGE



FINNED U-BEND TUBES SPEED WORK, CUT COSTS

by Ernest Dodd

Down Texas way, engineers are using a highly efficient and economical method for putting a little hustle into crude as it is moved from storage tanks at ambient temperatures.

Instead of tank suction heaters using prime surface tube, the Texans designed new heaters around Wolverine Trufin® Type S/T, finned tube of electric-welded steel, in U-bend form. The results—from the standpoint of both performance and economy—have been most satisfactory.

For example, because its integral fins give Trufin more than twice the effective heat transfer surface of plain tube, it was possible to design smaller heaters using fewer tubes. The result was a substantial saving in direct tube costs.

Despite their smaller size, the new units—with super-heated steam on the tube side—heat the crude from normal temperatures to 250°-300° F. This allows large quantities of the highly viscous crude to be withdrawn from the tank at a greatly increased rate of flow. The design used is a simple, single shell side pass over the U-bend tubes.

In addition to outstanding performance and the direct savings made in tube alone, the use of Wolverine U-bend tubes also contributed further savings in labor and material.

U-bend tubes were prefabricated by Wolverine to exchanger prints and packaged in expendable pallets in the exact order of their installation. On receipt of shipment it was only necessary for the equipment manufacturer to feed them directly from the pallet into the unit. Their use also resulted in the elimination of one tube sheet, a reduction by half of rolling-in operations and the elimination of floating head problems.

TRUFIN TYPE S/T IS WIDELY USED

Day by day throughout the entire heat transfer field, Wolverine Trufin Type S/T is being used in an increasingly large number of applications. Typical of the uses to which engineers are putting this capacity-boosting and cost-cutting integral finned tube, are: condensing freon and other refrigerants, condensing hydrocarbons, condensing organic chemicals, evaporating freon—water chillers, boiling hydrocarbons, heating or cooling gases, heating or cooling lube oils, transformer oils, absorber oils and quench oils.

Type S/T can be specified in any of a wide range of sizes and alloys in copper, aluminum or electric-welded steel. It is available with either 16 or 19 fins per inch. Because its integral fins give added support on bends, Trufin Type S/T can be fabricated just as readily as plain tube.

GOT A PROBLEM? JUST ASK F.E.S.

Among the many services Wolverine maintains for the convenience of its customers is the staff of highly trained tubing technicians in its Field Engineering Service.

These men, in addition to their individual training and knowledge, can draw on Wolverine's background of tubing experience to help solve customers' problems in design, corrosion, fabrication, etc. The staff is available at all times and their services impose no obligation.

SEND FOR FREE BOOK!

One of the most comprehensive sources of information available on finned tube is Wolverine's Trufin Opportunity Book. In addition to much background data, this book contains valuable information on designing with integral finned tube. There are a number of actual Trufin case histories describing performance boosts and cost reductions made possible by Trufin Type S/T. There is no charge for this book. Write for your copy—today.

INTERCHANGEABILITY

Complete interchangeability with prime surface tube is an important feature of Wolverine Trufin Type S/T. When retubing with Type S/T, only standard tools and tubing techniques are required. There is no deviation from normal procedure.

CALUMET & HECLA, INC.
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WOLVERINE TUBE
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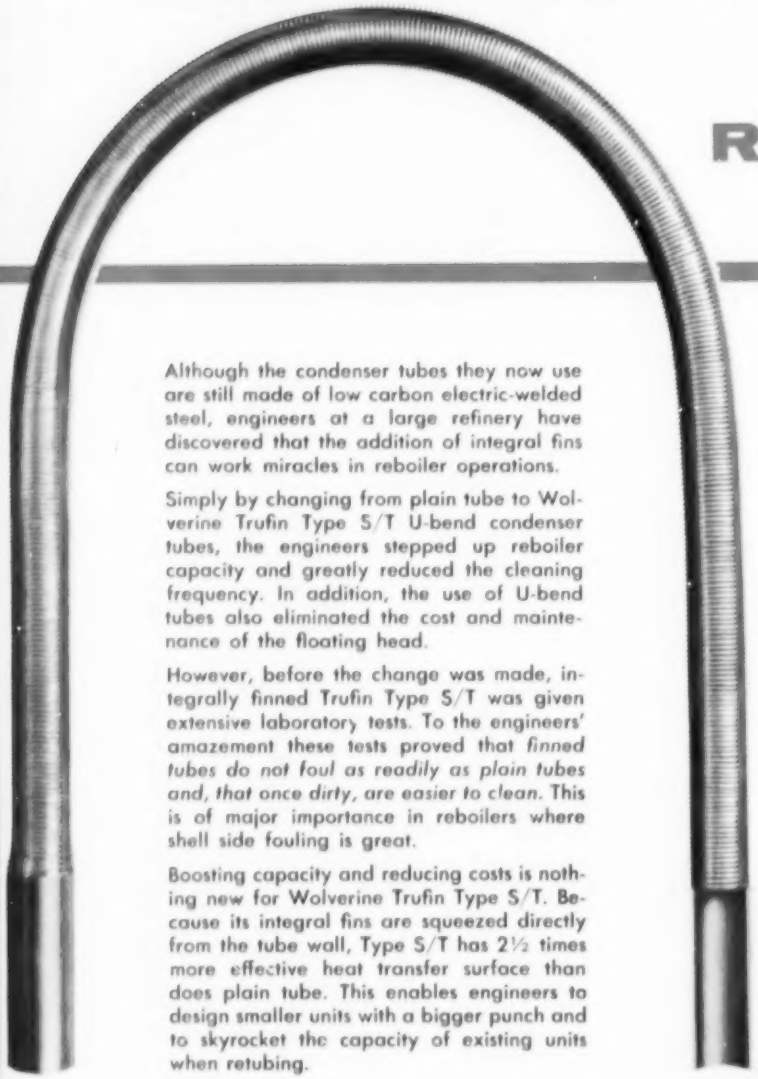
1441 Central Avenue, Detroit 9, Michigan
Manufacturers of Quality Controlled Tubing and Extruded Aluminum Shapes

the CONDENSER TUBE *for* REBOILERS



Although the condenser tubes they now use are still made of low carbon electric-welded steel, engineers at a large refinery have discovered that the addition of integral fins can work miracles in reboiler operations.

Simply by changing from plain tube to Wolverine Trufin Type S/T U-bend condenser tubes, the engineers stepped up reboiler capacity and greatly reduced the cleaning frequency. In addition, the use of U-bend tubes also eliminated the cost and maintenance of the floating head.

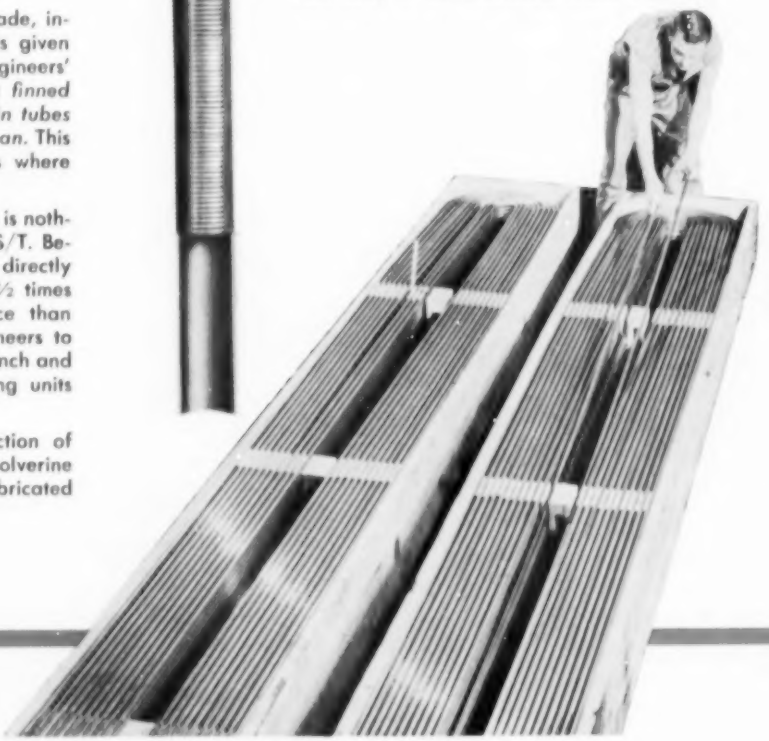
However, before the change was made, integrally finned Trufin Type S/T was given extensive laboratory tests. To the engineers' amazement these tests proved that *finned tubes do not foul as readily as plain tubes and, that once dirty, are easier to clean.* This is of major importance in reboilers where shell side fouling is great.

Boosting capacity and reducing costs is nothing new for Wolverine Trufin Type S/T. Because its integral fins are squeezed directly from the tube wall, Type S/T has 2½ times more effective heat transfer surface than does plain tube. This enables engineers to design smaller units with a bigger punch and to skyrocket the capacity of existing units when retubing.

In addition to its exclusive production of integrally finned condenser tube, Wolverine is also a direct mill source for prefabricated U-bend tubes.

Wolverine ships U-bends to the user in expendable pallets. They are removed in the exact order of their installation — reducing unit fabrication time, eliminating one tube sheet and cutting rolling-in operations by half.

If your plant operates reboilers, Wolverine Trufin Type S/T U-bend condenser tubes can help you increase capacity and reduce costs. Specify them for new equipment or when retubing. For complete information write for your copy of the Wolverine Trufin Catalog.



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Manufacturers of Quality Controlled Tubing and Extruded Aluminum Shapes

Wolverine Trufin available in Canada through the Unifin Tube Company, London, Ontario

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EXPORT DEPT., 11 E. 40TH ST., NEW YORK 16, N. Y.

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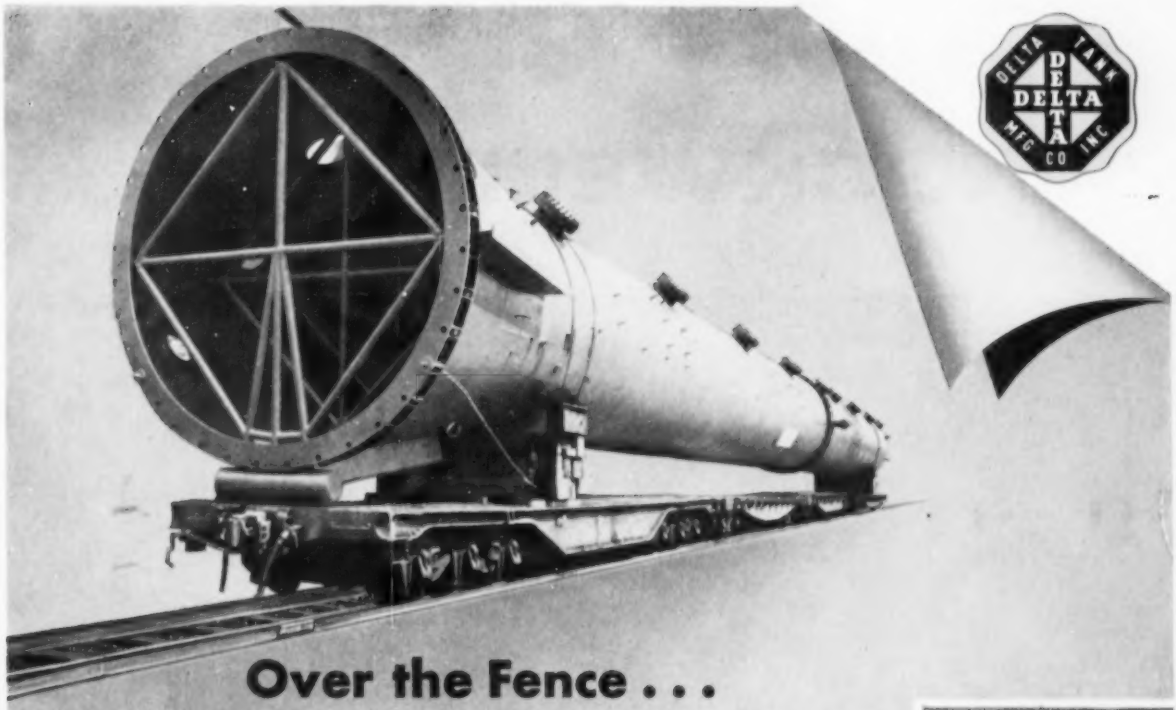
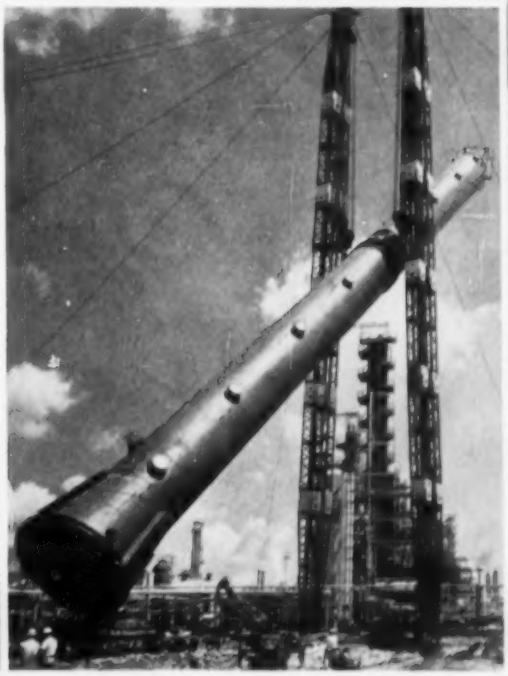
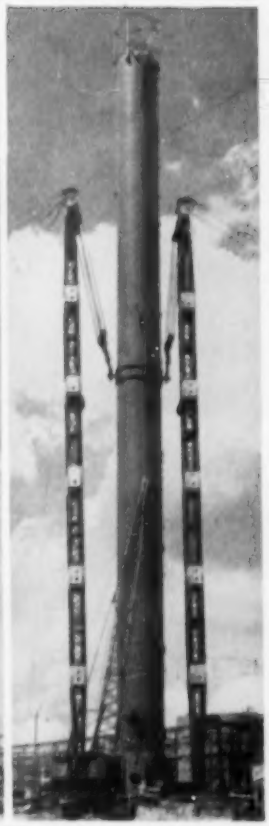


Over the Fence . . .

It was a short railroad trip for this giant Deisobutanizer Tower after fabrication in Delta's Baton Rouge plant. The tower was built for Esso Standard Oil, whose Baton Rouge refinery's south fence is the Delta plant's north fence. Four rail cars were necessary to move the giant into place for erection by Esso's own forces. Its gross weight is 410,000 pounds, with an overall length of 207 feet, two inches—more than a ton per foot. It was fabricated complete for shipment in one piece—The Biggest Yet!





DELTA TANK MANUFACTURING CO., INC.

BATON ROUGE, LOUISIANA

PLANTS: BATON ROUGE, LA. • MACON, GA. • BEARDSTOWN, ILL.
EXPORT OFFICE: INTERNATIONAL TRADE MART, NEW ORLEANS, LA.
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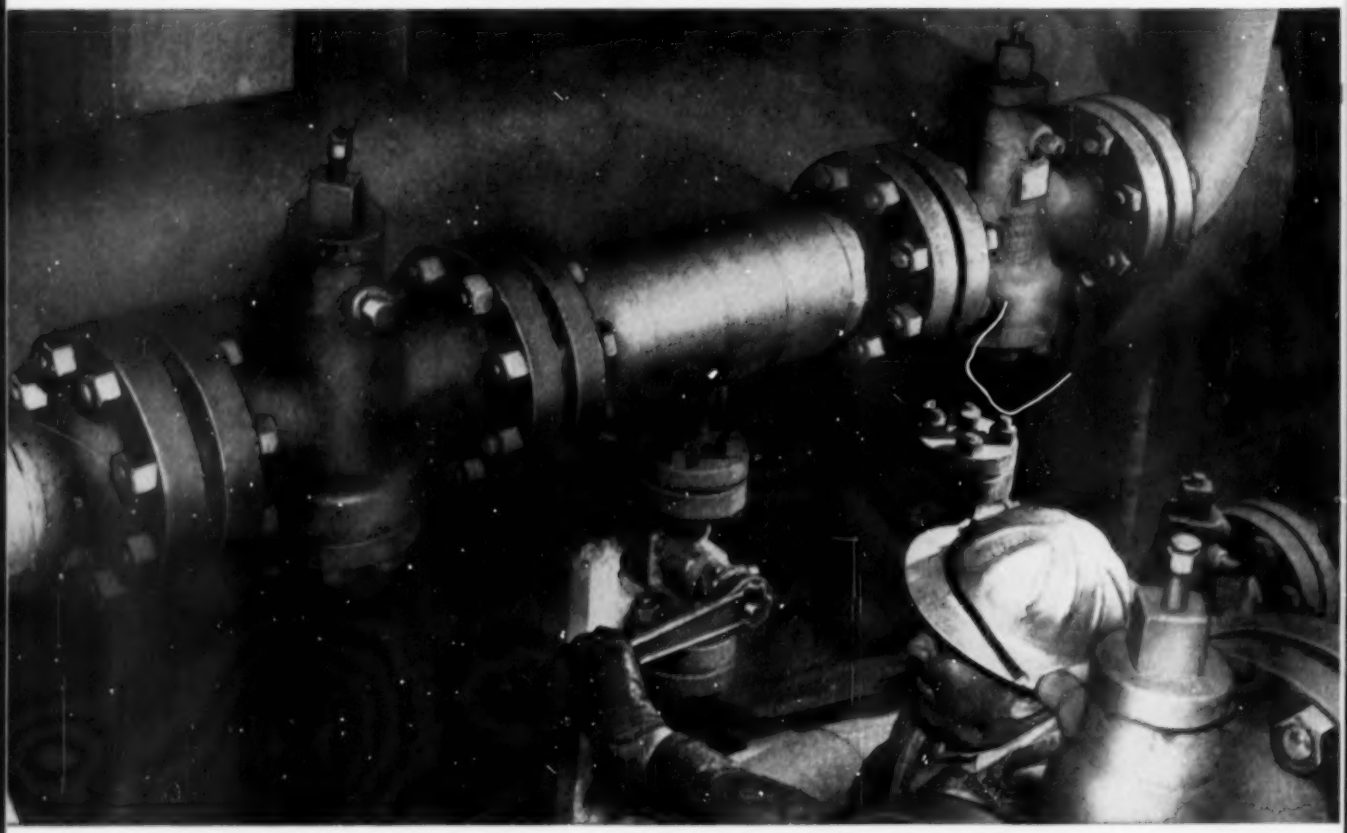
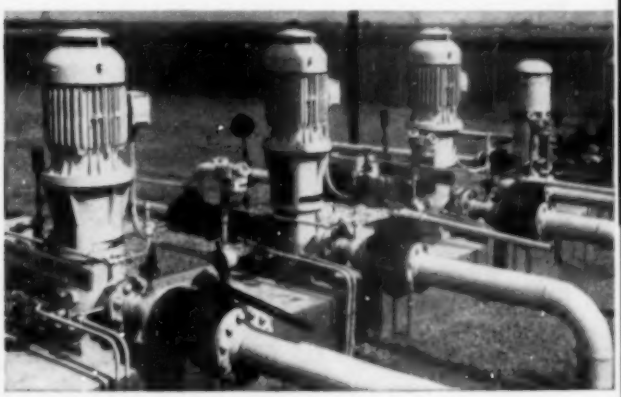
Where There's No

ROCKWELL-Nordstrom



Rockwell-Nordstrom lubricant sealed valves stay leakproof in polymerization plant service.

For refinery transfer lines, Rockwell-Nordstrom valves close with fast, easy, quarter-turn operation.



At gasoline plants, Rockwell-Nordstrom valves can't be matched for safety on light hydrocarbon services.

Time For Down-Time

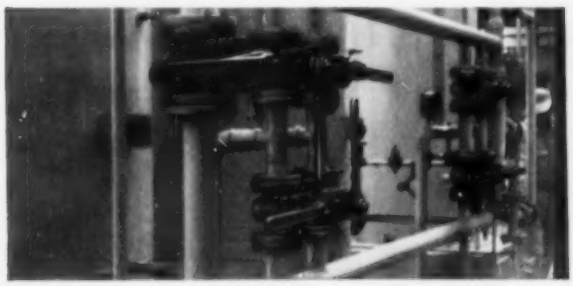
VALVES Perform Better, Longer, For Less Money

One good way to cut costly down-time in "round-the-clock" process units like refineries and gasoline plants is to use Rockwell-Nordstrom valves. That's why so many oil and gas companies standardize on Rockwell-Nordstrom valves where flow control *must* stay dependable and safe month after month.

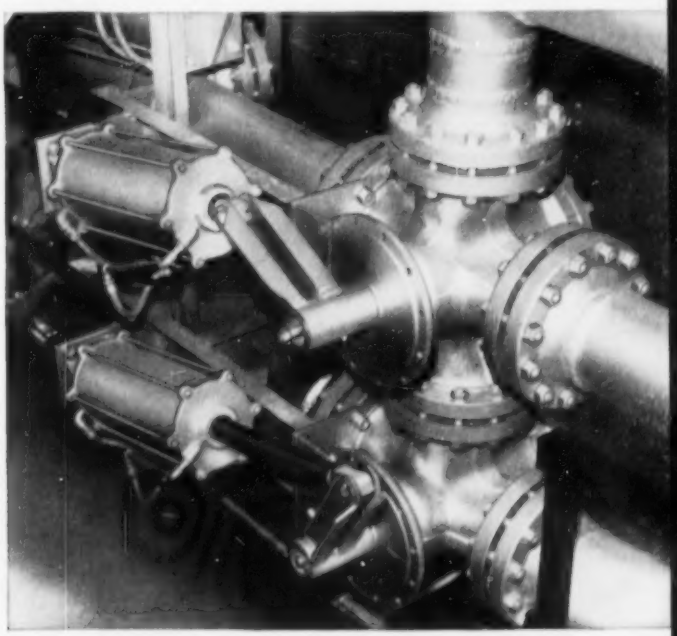
The reason for the greater dependability and safety of Rockwell-Nordstrom valves is *pressurized lubricant*. This forms a leakproof seal for tightest shut-off and jacks the plug for fast, easy quarter-turn operation. Lubricant also cuts maintenance costs and adds years to valve life by eliminating grinding metal-to-metal wear.

The original and world's most complete line, Rockwell-Nordstrom lubricated plug valves cost no more to buy—and far less to use—than any other valve. Available in WOG ratings to 10,000 lb. and sizes to 30 x 34" in steel, stainless, semi-steel and corrosion resisting metals. Write for more details: Rockwell Manufacturing Company, Pittsburgh 8, Pa. *Canadian Valve Licensee:* Peacock Brothers Limited.

Rockwell-Nordstrom valves on cooling tower water lines operate two to five times faster than ordinary valves.



Rugged design and unexposed seating in Rockwell-Nordstrom valves prevent pump shock load wear on glycol circulation service.



These air operated 4-way Rockwell-Nordstrom Multiport valves on cat reformer stills make control of recycle gas lines fast and dependable.

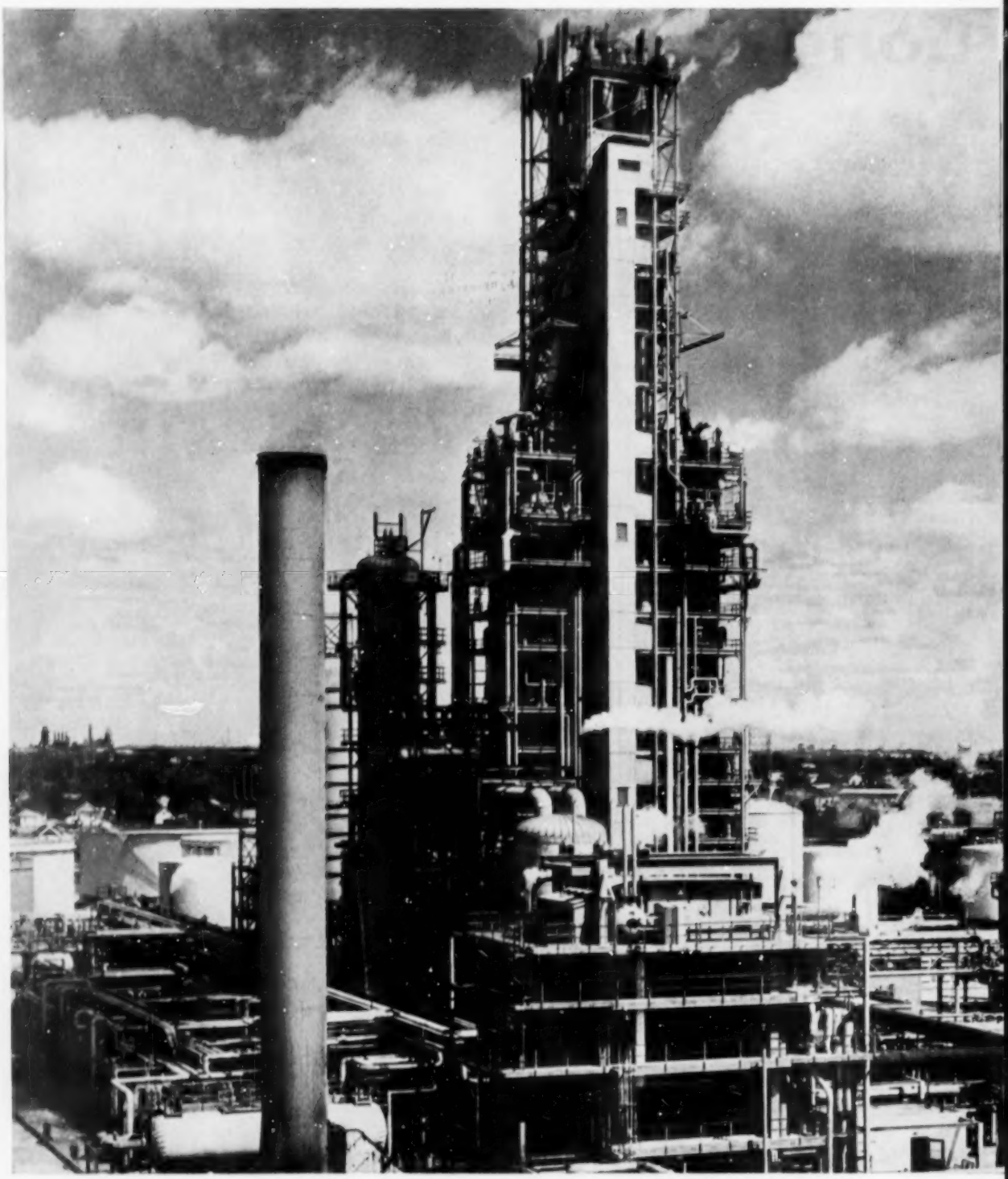
ROCKWELL-Nordstrom VALVES

Lubricant Sealed for Positive Shut-off

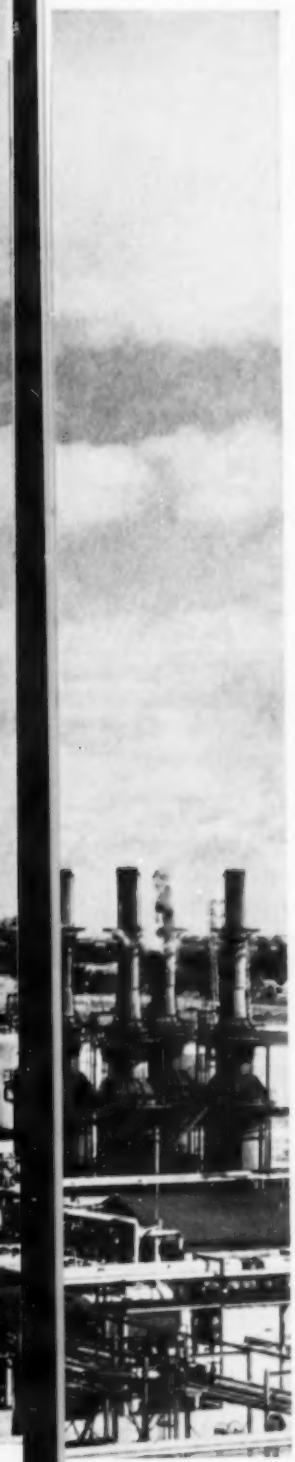
40th YEAR *of lubricated plug valve leadership*

Refinery Operating Records Prove...

Fuel Costs Go Down When



A B&W CO Boiler Goes In



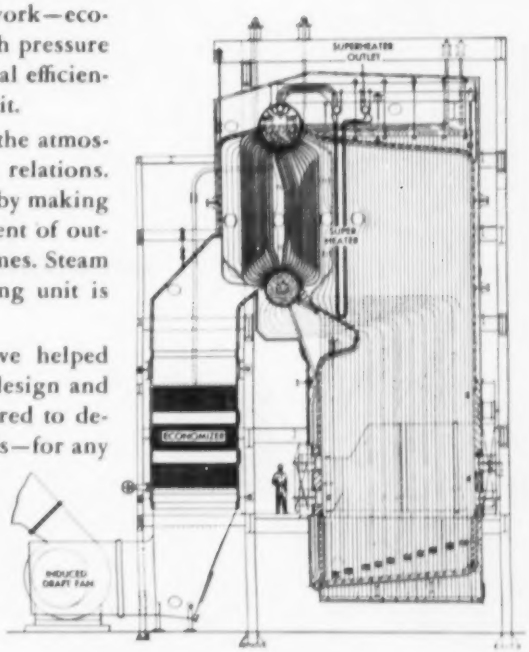
Savings Can Be Calculated in Thousands of Dollars... Atmosphere is Kept Clean

Designed and developed to raise refinery thermal efficiency to still higher levels, the B&W CO Boiler has effectively demonstrated its *reliability, efficiency and economy in extended, sustained service.*

FUEL SAVINGS ARE SUBSTANTIAL because sensible and combustible heat content is put to work—economically. Steam can be produced at high pressure and temperature, resulting in high thermal efficiencies for prime movers of the cracking unit.

OTHER ADVANTAGES include keeping the atmosphere clean for improved community relations. Also, the CO Boiler simplifies operation by making your cracking unit completely independent of outside sources of steam and energy at all times. Steam is always available—whether the cracking unit is operating or shut down.

DIFFERING REFINERY CONDITIONS have helped develop CO Boilers that are flexible in design and arrangement. B&W engineers are prepared to design a unit that will meet your exact needs—for any steam pressure or temperature and *any size* cracking unit—large or small. Write for details—The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, New York.



B&W CO Boiler in midwestern refinery delivers 190,000 pounds of steam per hour at 500 psi and 575 F. It saves 44½ million BTU's per hour.

BABCOCK & WILCOX

BOILER DIVISION

G-814-CO

(To obtain more data on advertised products see page 114)

Right from the start–

For more than forty years UOP has been the leading independent petroleum research organization. Over the years it has been responsible for the development of many of the most important refining processes now in use. The results of UOP research have always been made available to all refiners, anywhere in the world.

In cooperation with the technological and manufacturing staffs of these refiners the application of these processes has made a major contribution to the continuing betterment and marketability of petroleum products.

Forty Years Of Leadership In Petroleum Refining Technology

Research is working to make petroleum products better

Throughout the great petroleum industry there are thousands of scientists, technicians, engineers devoting their efforts exclusively to research. Their efforts range from the development of an abstract theory in the laboratory to the practical application of it in the field or at the refinery.

Yet, right from the start, most everything that is done in petroleum research concentrates on the development of improved products from petroleum, products better fitted to answer the demand of today's economy, products that fill as well as anticipate the growing public need.

Research, too, is devoted to the task of helping the refining industry get the most out of every barrel of crude that is processed in its plants. This makes possible the economical manufacture of petroleum products and their availability to the broadest markets at reasonable prices.

We have a lot of these men of science here at Universal, and there are lots more on the research staffs of refiners everywhere. It is good to know that their efforts are concentrated on the continual improvement of petroleum products, a satisfying assurance that the oil industry will continue to fulfill its responsibilities.

UOP

UNIVERSAL OIL PRODUCTS COMPANY

30 ALGONQUIN ROAD, DES PLAINES, ILLINOIS, U.S.A.

ALUNDUM*

High-Purity Fused Alumina

How can you use it to advantage?

Among the many electrochemically refined materials produced by Norton Company, ALUNDUM fused alpha alumina is one of the most widely useful to industry. Thanks to its inherent properties of hardness, chemical stability and high density, engineers in various fields are finding many new applications for it.

Norton fused alumina is produced in a number of forms. Of these, 38 ALUNDUM* grain has proved particularly successful in applications demanding high purity. Electrically fused from Bayer-processed alumina, this white grain is shown by typical chemical analysis to be 99.49% pure Al_2O_3. It is insoluble in common solvents and extremely resistant to reduction. It is an amphoteric refractory and has high dielectric strength. Other characteristics include:

Melting point	**about 3600°F.**
Specific gravity	**3.94**
Crystal structure	**hexagonal system (rhombohedral division)**
Hardness	**9.0 Mohs' scale**
Index of refraction	**1.76 mean**

Typical Product Applications in which Norton high-purity fused alumina is now working out to advantage are:

For Catalytic Reactions. Norton fused alpha alumina carriers are outstanding for chemical stability and resistance to abrasion and erosion. Available in the form of spheres, rings and pellets they are used both in fixed bed oxidation reactions and as inert, low-density carriers for space filler applications where a low surface area (less than $1 m^2/gm$) is required. Other types of ALUNDUM catalyst carriers having surface areas in the range 5-60 m^2/gm are also available.

In Pebble Heaters. ALUNDUM heat exchange pebbles are giving excellent results in pebble heaters for heating gases above operating temperatures permissible in conventional tube furnaces. Their great resistance to abrasion, impact and repeated heating and cooling make them the ideal heat transfer medium in these devices. Also, their high refractoriness prevents them from the softening and "bridging" together that causes stoppages in the heater's moving bed.

In Thermal Cracking Reactors. Particularly in Wulff Process Generators for cracking light hydrocarbons to produce acetylene gas and Koppers-Hasche Generators for cracking light hydrocarbons to produce a variety of gases and petrochemicals — checkers made of Norton ALUNDUM high-purity fused alumina provide definite advantages. Their excellent heat transfer properties, high refractoriness and resistance to erosion caused by hot gases are important Their ability to withstand the thermal stresses of intermittent operation assures long life. And their purity prevents side reactions with the reacting gases, thus safeguarding product quality.

In Gas Synthesis Generators. ALUNDUM fired shapes are ideal for lining generators of this type. Among the inherent characteristics of Norton high-purity fused alumina that work out very well are: high refractoriness, chemical stability, and inertness that prevents reacting with the contacting atmospheres.

Very many other uses for Norton high-purity fused alumina materials include: pure oxides and sintered refractories, refractory cements, wear-resistant parts, laboratory ware, coatings for rocket and jet plane parts and atomic energy equipment.

Other Norton Electrochemically Refined Materials

include CRYSTOLON* silicon carbide, MAGNORITE* magnesium oxide, NORBIDE* boron carbide, FUSED ZIRCONIA and many others, including a number still under development. These high-melting materials, which have varied applications in many fields, are also the basic ingredients of the famous Norton Refractory Rx's — refractories *engineered and prescribed* for the widest range of uses.

For Your Own Applications Or Developments

Norton Company not only supplies these materials in crude form, but has extensive facilities for processing and fabricating — and is ready to work with you in engineering materials to your particular requirements. A new booklet "Norton Refractory Grain — Electrochemically Refined" contains detailed information. For your copy, write to NORTON COMPANY, Refractories Division, 271 New Bond Street, Worcester 6, Massachusetts.

NORTON

REFRACTORIES

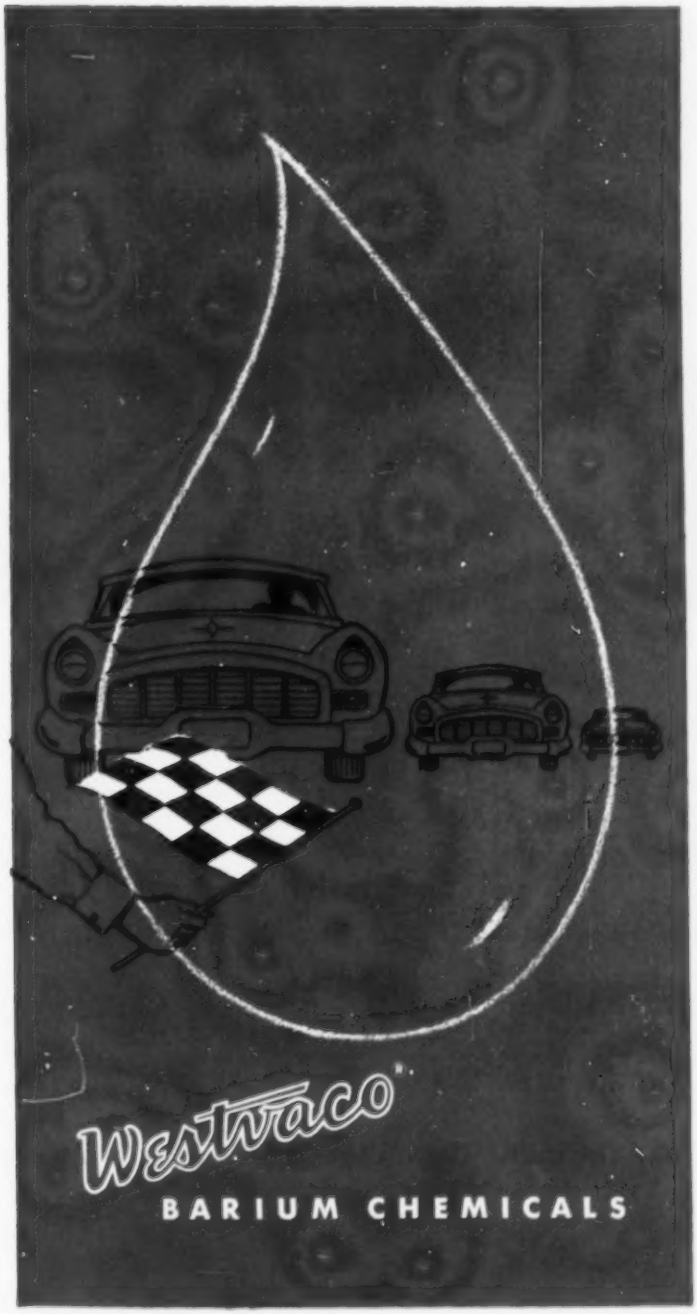
Engineered... Rx... Prescribed

Making better products... to make your products better

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

(To obtain more data on advertised products see page 114)

Ba *laps the detergent additive field!*



Rising compression ratios in modern motor cars accelerate the lube oil industry's 3-to-1-and-growing preference for Barium Oxides as the basis of their detergent additives!

As the demand grows, Westvaco continues to anticipate it with expanded mineral reserves, increased electric furnace capacity and improvements in processing and customer service. Most important recent news was Westvaco's announcement that another 30% increase in output of Barium Oxide had been achieved as the result of an exclusive process developed by Westvaco engineers.

Whatever the future demand... we will continue to supply the industry's needs for Barium Oxide in dense, crystalline form . . . Barium Octahydrate and Barium Pentahydrate in soluble flake form.

Westvaco CHEMICALS

Westvaco Mineral Products Division
FOOD MACHINERY AND CHEMICAL CORPORATION
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fmc FOOD MACHINERY AND CHEMICAL CORPORATION

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(To obtain more data on advertised products see page 114)

NOW! A CATFORMING

Here's important news for refiners who are finding it increasingly difficult to meet today's higher octane requirements with present processes and catalysts. Atlantic offers an advanced Catforming catalyst designed to do a better, more economical job. The new catalyst combines ability to make higher octane quality products and an improved stability. These catalyst qualities mean greater process flexibility, and they are applicable in your present equipment. For full information on Catforming, write, wire or call The Atlantic Refining Company, P.O. Box 8138, Philadelphia 1, Pa.

NEW

CATALYST

HIGHER GASOLINE OCTANES THROUGH PENTAFINING

You can convert the low-quality n-paraffins (C_5, C_6, C_7) in your gasoline pool to high octanes! Pentafining, the process developed by The Atlantic Refining Company, makes it possible. For full particulars, write today to The Atlantic Refining Company, P. O. Box 8138, Philadelphia 1, Pa.

it's the **CATALYST** that counts

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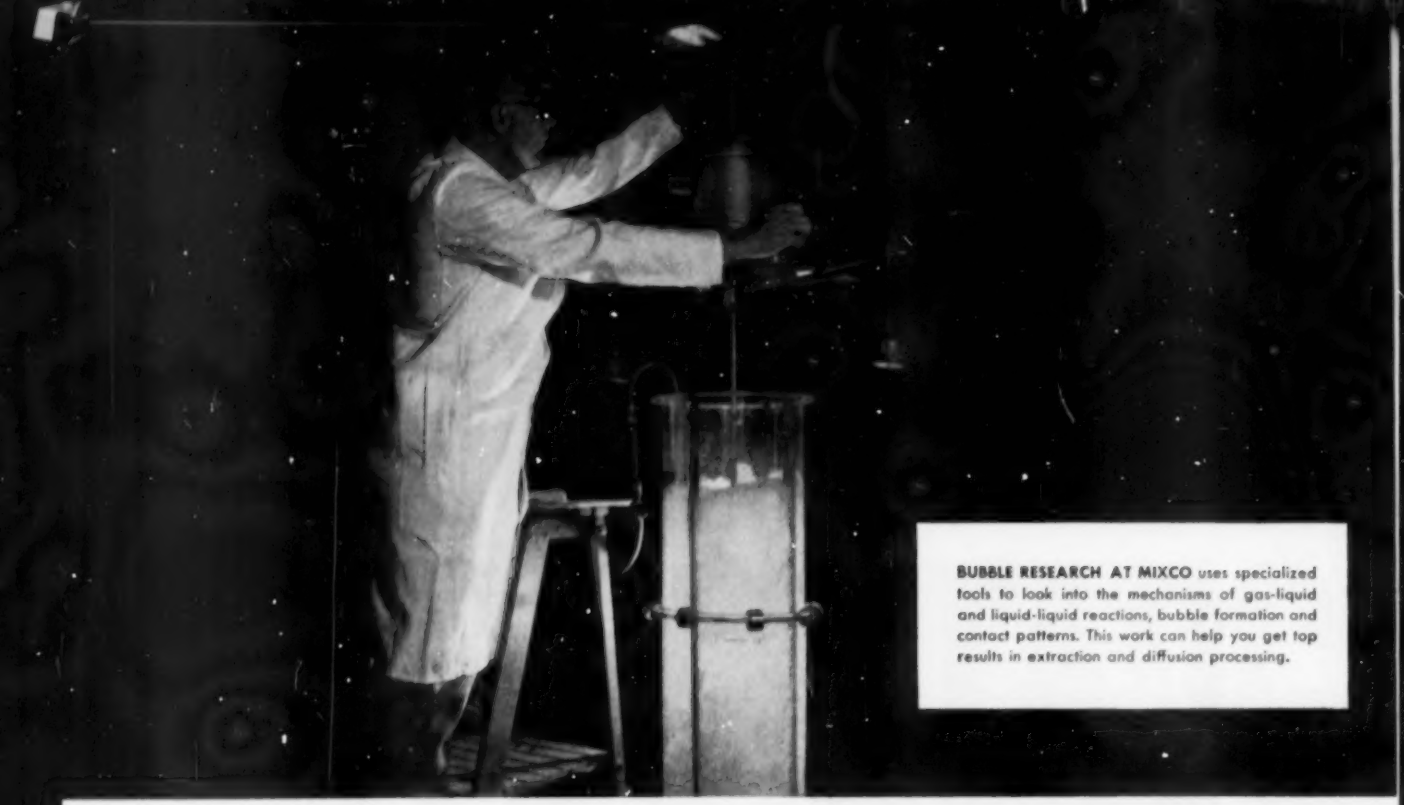

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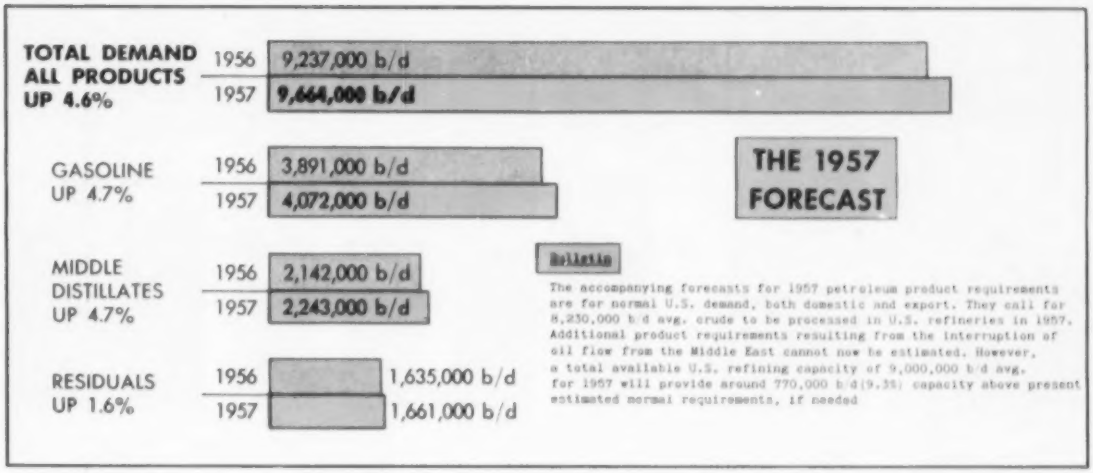
Petroleum Processing
DECEMBER 1956


TOTAL DEMAND ALL PRODUCTS UP 4.6%
1956 9,237,000 b/d
1957 9,664,000 b/d
GASOLINE UP 4.7%
1956 3,891,000 b/d
1957 4,072,000 b/d
THE 1957 FORECAST
MIDDLE DISTILLATES UP 4.7%
1956 2,142,000 b/d
1957 2,243,000 b/d
Bulletin
The accompanying forecasts for 1957 petroleum product requirements are for normal U.S. demand, both domestic and export. They call for 8,230,000 b/d avg. crude to be processed in U.S. refineries in 1957. Additional product requirements resulting from the interruption of oil flow from the Middle East cannot now be estimated. However, a total available U.S. refining capacity of 9,000,000 b/d avg. for 1957 will provide around 770,000 b/d(9.3%) capacity above present estimated normal requirements, if needed
RESIDUALS UP 1.6%
1956 1,635,000 b/d
1957 1,661,000 b/d

All Products Up in 1957

Annual forecast shows bright year ahead for petroleum processor though with shifting product ratios

By V. B. GUTHRIE, Associate Editor

THE GROWING consumption of gasoline and distillate fuel oil in this country will push total U. S. product demand to 9,664,000 b/d average in 1957, 4.6% higher than the current estimated total for 1956, and well on the way to an 8-Figure mark. (See chart above.)

This new all-time peak demand is shown in PETROLEUM PROCESSING's annual sizeup of the coming year's petroleum requirements. The survey assumes that conditions in the Middle East will not materially change world-wide supply-demand conditions in 1957.

The year 1956 will turn out to be even better than was anticipated last January, the survey also shows. Total U. S. product demand this year (domestic and export) will average 9,237,000 b/d, 5.2% higher than in 1955.

The growth in product requirements in the coming year, as in 1956, will be entirely in the domestic markets. Exports, forecast at 323,000 b/d, average in 1957, will be 3% less than in 1956. The outlook for individual product domestic demand in 1957 shapes up as follows:

Gasoline: 3,987,000 b/d average, 4.8% larger than in 1956, with requirements in the second and third quarters reaching above 4,100,000 bbl.

Distillate Fuel Oil: 1,841,000 b/d, based on normal temperatures this winter. This is 6% larger than in 1956.

Kerosine: 333,000 b/d, unchanged from 1956.

Residual Fuel Oil: 1,593,000 b/d, based on a normal winter, 1.8% larger than in 1956. Imports of around 470,000 b/d will be required to meet market needs in this country.

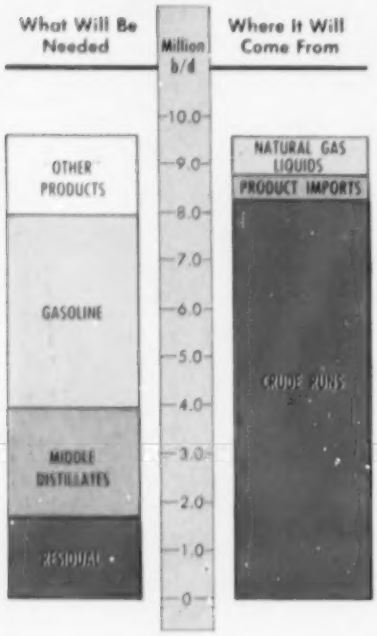
Jet Fuels: 217,000 b/d, practically all from the military services, 18.6% larger than estimated for 1956.

Lubricating Oils: 122,000 b/d, 1.7% larger than in 1956; the largest share of the demand will be for industrial lubes.

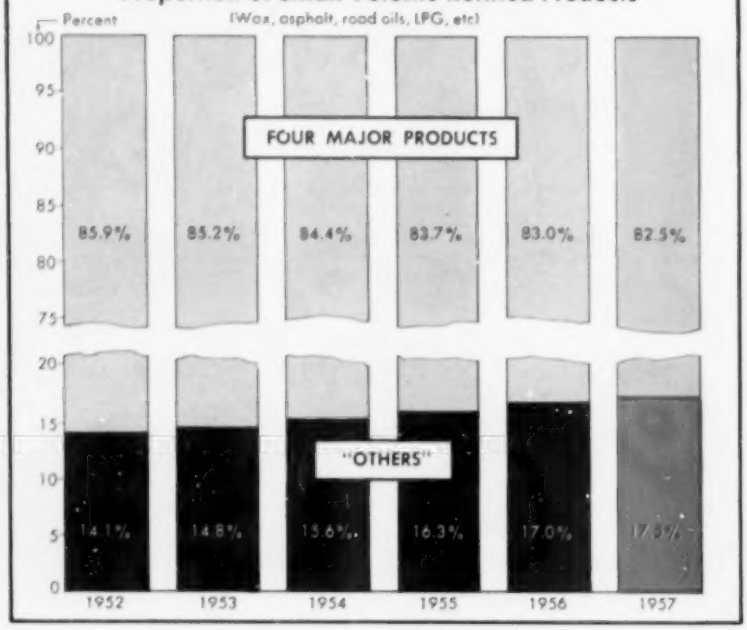
Other Products (wax, asphalt, road oils, liquefied petroleum gas and others): 1,248,000 b/d average

■ Forecast for 1957

For Balanced Supply and Demand in 1957



Also Growing Steadily – Proportion of Small Volume Refined Products



Figures for Chart Above

(In million b/d)

What is Needed:	
"Others"	1.688
Gasoline	4.072
Middle Dist.	2.243
Residuals	1.661
Totals	9.664
Where It Will Come From:	
Natural Gas Liquids	.923
Product Imports	.511
Crude Runs	8.230
Totals	9.664

for 1957, 7.3% larger than in 1956.

These demand forecasts are compiled by PETROLEUM PROCESSING Editors from estimates individually submitted by economists with oil companies, banks, government agencies and authorities in the automotive and other industrial fields who are large users of petroleum products. A survey on the general business outlook for the coming year is supplied by the McGraw-Hill Economics Dept. All told, 40 individuals and agencies were polled in making up the 1957 forecast. (which appears in tabular form on p. 39.)

To meet total product demand as now forecast—and not add further to overall product stocks during 1957—refiners will charge to their stills a daily average of 8,230,000 bbl of crude, process 923,000 bbl of natural gas liquids and import 511,000 bbl of products, mainly heavy fuel oil.

A higher rate of crude runs than is needed for the year's product requirements will add further to gasoline inventories—already at burdensome level. Based on anticipated balanced refinery operations, gasoline stocks at refineries Dec. 31, 1957 will be 185,000,000 bbl, compared with an estimated 186,000,000 bbl Dec. 31, 1956. Kerosine inventories will remain unchanged at 27,000,000 bbl. Distillate fuel oil inventories will be 125,000,000 bbl, compared with 122,000,000 bbl Dec. 31, 1956. Residual fuel oil stocks will be 43,000,000 bbl, unchanged from Dec. 31, 1956.

1956 Outstripped Forecasts

Total oil product demand in 1956, it is now estimated, will reach 9,237,000 b/d average, an increase of 5.2% from 1955 actual requirements. This total is about 225,000 bbl larger than was forecast by PETROLEUM PROCESSING at the start of the year. Larger-than-anticipated consumption of gasoline and distillate fuel oil caused all agencies to revise their forecasts of demand during the year. The presently estimated 5.2% increase in demand is under the 7% gain in total demand in 1955 from 1954.

The 1956 gain is all in domestic requirements, which are estimated at 5.8% larger than in 1955. Exports in 1956 of 366,000 b/d average, will be about 9% smaller than the year previous.

Domestic gasoline requirements in 1956 are set at 3,803,000 b/d average, a gain of 5% from 1955. Exports are lower this year and total demand is estimated at 3,891,000 b/d, 4.7% above 1955.

Domestic kerosine demand for 1956 will be around 333,000 b/d average, 4.1% larger than in 1955. Exports dropped sharply and total 1956 demand, 340,000 bbl., is 3.3% larger than for 1955.

Domestic distillate fuel oil demand will show the largest rate of gain in 1956 of any of the major products. The current estimate, 1,737,000 b/d average, is 9% above 1955. A cold late winter is responsible for the size of the gain. Total distillate fuel oil requirements will be 1,802,000 bbl, 8.6% above that of 1955.

Domestic demand for residual fuel oil in 1956 is estimated at 1,565,000 b/d average, 2.5% larger than in 1955. A drop of 23.1% in the already small exports brings total demand to 1,635,000 b/d average, 1.1% above 1955.

Largest rate of gain in 1956 for any product will be in jet fuels, where shipments of 183,000 b/d average will be nearly 19% larger than for 1955. Requirements are practically

100% from the military services. Lubricating oils, with small gains in both domestic trade and exports, will total 160,000 b/d in 1956, 3.2% larger than in 1955.

Growth in 1956 demand for the relatively small volume products—wax, asphalt, road oil, liquefied petroleum gas, among others—is entirely in this country. Domestic requirements, 1,163,000 b/d, are 7.3% higher than in 1955. With exports 4.5% smaller in 1956, total demand is 1,226,000 b/d, 6.6% larger than 1955.

Runs of crude oil in U.S. refineries in 1956, it is now estimated will reach 7,957,000 b/d average. Product imports in 1956 will average 490,000 b/d, about 90,000 b/d higher than estimated early in the year. Utilization of natural gas and refinery gas liquids in product manufacture in 1956 is estimated at around 920,000 b/d average. Supply used in refinery operations thus totals 9,367,000 b/d average for the year, around 130,000 b/d higher than the revised estimate of 1956 product demand of 9,237,000 bbl.

The high rate of refinery operations in relation to demand is reflected in the increase of 35,300,000 bbl in refiners' stocks of the major products, which it is now estimated will take place in 1956. Gasoline inventories Dec. 31, 1956, are estimated at 186,000,000 bbl, 20,600,000 bbl higher than Dec. 31, 1955. Distillate fuel oil inventories, at an estimated total Dec. 31, 1956 of 122,000,000 bbl, are 10,700,000 bbl higher. Kerosine inventories, 27,000,000 bbl, are practically the same. Residual fuel oil, at 43,000,000 bbl Dec. 31, 1956, will be 3,800,000 bbl higher than at the end of 1955.

Outlook Is Progressively Good in 1957

Total product demand in 1957 is forecast at 9,664,000 b/d average,

Here Are Some of the Economists Who Made This Survey Possible

J. W. Ferguson, dir. of economics and statistics div. of Continental Oil Co.'s coordinating and planning dept. Before Conoco, he was with the Bureau of Mines, and gas companies in Texas and Colorado.

J. G. Winger, petroleum economist with Chase Manhattan Bank since 1950, did similar work at Cities Service Oil Co. before joining Chase. He is editor of a monthly petroleum industry survey.

W. L. Leavitt, is director of the research division of Standard Oil Co. (Indiana). Mr. Leavitt has been at Stanolind since 1946, after being engaged in economics work in banks and universities.

J. E. Jensen, petroleum economist at the Federal Reserve Bank of Dallas, took his BA, MA and PhD, all in economics, at the U. of Wisconsin. He has taught economics at Pacific Lutheran College and Drake.

J. S. Cross, mgr., statistical research dept., Sun Oil Co. has taught economics and marketing at Penn State University and MIT. Active in AEA, ASA. Co-authored volume, "Industrial Marketing."

E. T. Knight, associate economist, Atlantic Refining Co. has been with his company for 36 years. He is a member of the American Petroleum Institute and its Statistical Advisory Committee.

Austin Cadle, mgr., economics dept., Standard Oil Co. of Calif., joined Socal in 1922 after studying geology at Stanford. He was geologist, later, cost analyst. He is active in the National Petroleum Council and the API.

N. G. Dumbross, mgr., economics and statistics department, The Ohio Oil Co. With Ohio 11 years after leaving Petroleum Administration for War where he was engaged in economics work. Member of AIMME and API.

A. J. McIntosh, chief economist, Socony Mobil Oil Co., has been with Socony 33 years, most of that time in the statistics-economics department. He is a frequent writer and speaker on various phases of economics.

E. F. Perkins, petroleum economist, executive dept., has been with Gulf Oil Corp. since 1924. He has been engaged in economics work since 1936, after serving in engineering and plant supervision in his company.

Major General L. E. Cotulla, Staff Director for Petroleum Logistics, Office of the Assistant Secretary of Defense, has served as petroleum officer of the Caribbean Defense Command, and petroleum supply officer for the Washington Quartermaster Depot, as well as in other capacities in both the Quartermaster and the Engineer Corps. He was also a petroleum geologist before his active military career.

T. H. Gilbert, Executive Vice-president's Office, Shell Oil Co. received his M.B.A. from the Graduate School of Business Administration, New York University. Mr. Gilbert, who has been at Shell for 15 years, has been in the Financial Vice-president's Office, and Economic Development. He did county demand studies for the Petroleum Administration for Defense in 1951 as a demand consultant.

Petroleum Demand, 1956-1957

(1000 bbl annually)

	1957*			1956**		
	Domestic	Export	Total	Domestic	Export	Total
Gasoline	1,455,255	31,025	1,486,280	1,391,898	32,208	1,424,106
Kerosine	121,545	2,555	124,100	121,878	2,562	124,440
Dist. Fuel Oil	671,965	22,630	694,595	635,742	23,790	659,532
Residual Oils	581,445	24,820	606,265	572,790	25,620	598,410
Jet Fuels	79,205	***	79,205	66,978	***	66,978
Lubes	44,530	14,235	58,765	43,920	14,640	58,560
All Other	455,520	22,630	478,150	425,658	23,058	448,716
Totals	3,409,465	117,895	3,527,360	3,258,864	121,878	3,380,742

*Petroleum Processing Forecast
**Estimated
***Not reported
Note: 1956 has one extra day

an increase of 427,000 bbl (4.6%) from the current estimate for 1956. The fact that gasoline demand now holds up through the winter and that distillate fuel oil demand continues to grow, indicates that fourth quarter estimated total product demand of 10,294,000 b/d average will be the largest during the coming year, by a small margin over the first quarter.

As in 1956, growth will be entirely in domestic requirements. Total domestic needs are forecast at 9,341,000 b/d average, 4.9% larger than in 1956. Exports are expected to drop around 3% from 1956 to 323,000 bbl.

Domestic gasoline needs in 1957 are estimated at 3,987,000 b/d average, 4.8% higher than in 1956. The trend toward more vacation travel in early summer is bringing up second quarter consumption to the point where it is now close to third quarter requirements. Demand in both quarters will run over 4,100,000 b/d average. Exports will be lower in 1957, bringing total gasoline to 4,072,000 b/d average, 4.7% larger than now estimated for 1956.

Domestic distillate fuel oil needs in 1957 are forecast at 1,841,000 b/d average, 6% over 1956, compared with a gain of 9% in 1956 from 1955. As with other products, exports will be lower and total distillate fuel oil demand will be 1,903,000 b/d average, 5.6% larger than now estimated for 1956. The relatively rapid growth in the use of this product, the past few years, is shown by the fact that distillate fuel oil sales as forecast for 1957 will be 46% of total gasoline demand. In 1950 they were 40% of gasoline sales.

Kerosine demand in 1957, both domestic and export, will remain at the 1956 level of 340,000 b/d average.

Residual fuel oil requirements 1,593,000 b/d domestic and 1,661,000 total) in both cases are less than 2% above the 1956 figures. Lubricating oil needs, both domestic and export, are only slightly above 1956.

Largest rate of growth in any product in 1957, as in 1956, will be in jet fuels, where estimated requirements of 217,000 b/d average, all in domestic usage, will be 18.6% higher than in 1956. Demand will be almost entirely military. Jet fuel consumption in commercial gas turbine powered aircraft will not be a factor in total demand until 1959-60. U. S. military jet fuel procurement for the fiscal year ending June 30, 1957 is now programmed for 258,000 b/d average.

One or Two Premiums?

Stepping up the compression ratios of the '57 models will intensify the problem many refiners will face next year in deciding whether to market one or two grades of premium motor fuel. Eight or ten of the new model cars will have compression ratios of 10:1, or close enough to it to call for a gasoline in the 100-octane range, which the new premium fuels are meeting.

Nine companies in 1956 introduced new higher octane premium grades, six selling a second grade and three increasing the octane ratings of their established premiums. The new fuels to date have been marketed mainly in New England, along the Atlantic seaboard, in the south and in Texas. Sales are expected to spread across most of the country in 1957.

The current trend in marketing premiums will be to sell two grades, one around 100-octane and tailored especially for the new models. The reasoning is that, for most oil companies it will cost less to take the cream of their gasoline pool, make up a special premium and put in the extra tanks and pumps to sell it, than to upgrade the entire volume of their premium components.

Some refiners say the manufacturing cost of raising the antiknock value of their total volume of premium would be around 0.5¢ a gallon, while the segregation of high octane components into a special premium would not be over 0.25¢. On the other hand, the cost of equipping a large number of stations to sell three grades of gasoline can be "staggering," as one company expresses it. Which road to take, to provide a fuel meeting the full antiknock requirements of the new models, will be a problem for the individual oil company.

Refiners Must Recognize Shift in Product Ratios

The changing relationship the past few years between gasoline and distillate fuel oil demand has been demonstrated in 1956 in the large buildup in gasoline stocks, and in the trend in wholesale market prices for the two products. This will be further emphasized in 1957, because distillate fuel oil demand is forecast to grow at a more rapid rate than gasoline demand. Refiners may be called on to take steps to adjust their yields from crude, more in line with the current ratio of demand for these products.

Gasoline requirements at refineries from 1952-55 increased nearly 15%; distillate fuel oil demand increased 19% in the same period.

Results of the discrepancy between demand and supply rates of the two products have shown in stock trends. Gasoline inventories at year-end increased over 30,000,000 bbl from 1952-55, and in 1956 the increase over 1955 is estimated at 20,500,000 bbl, a total gain in these inventories of over 50,000,000 bbl. Distillate fuel oil stocks at refineries Dec. 31, on the other hand, increased about 12,-

Forecast of Petroleum Demand, 1955-1957

(1000 b/d average)

	1957*								
	1st quar.	2nd quar.	3rd quar.	4th quar.	Year 1957	Year 1956**	% Change '57 from '56	Year 1955	% Change '56 from '55
DOMESTIC									
Gasoline	3,589	4,182	4,191	3,954	3,987	3,803	+ 4.8	3,621	+ 5.0
Kerosine	485	187	209	456	333	333	—	320	+ 4.1
Dist. Fuel Oil	2,576	1,325	1,228	2,234	1,841	1,737	+ 6.0	1,593	+ 9.0
Residual Oils	1,852	1,448	1,335	1,718	1,593	1,565	+ 1.8	1,527	+ 2.5
Jet Fuels	199	218	230	225	217	183	+18.6	154	+18.8
Lubes	117	125	126	121	122	120	+ 1.7	116	+ 3.4
All Other	1,127	1,226	1,376	1,265	1,248	1,163	+ 7.3	1,084	+ 7.3
Total Domestic	9,945	8,711	8,695	9,973	9,341	8,904	+ 4.9	8,415	+ 5.8
EXPORTS									
Gasoline	78	86	89	86	85	88	— 3.4	94	— 6.4
Kerosine	7	8	8	6	7	7	—	9	—22.2
Dist. Fuel Oil	54	64	66	63	62	65	— 4.6	67	— 3.0
Residual Oils	63	71	71	67	68	70	— 2.9	91	—23.1
Jet Fuel					(Not reported)				
Lubes	38	40	39	39	39	40	— 2.5	39	+ 2.6
All Other	62	64	63	60	62	63	— 1.6	66	— 4.5
Total Exports	302	333	336	321	323	333	— 3.0	366	— 9.0
TOTAL DEMAND									
Gasoline	3,667	4,268	4,280	4,040	4,072	3,891	+ 4.7	3,715	+ 4.7
Kerosine	492	195	217	462	340	340	—	329	+ 3.3
Dist. Fuel Oil	2,630	1,389	1,294	2,297	1,903	1,802	+ 5.6	1,660	+ 8.6
Residual Oils	1,915	1,519	1,406	1,785	1,661	1,635	+ 1.6	1,618	+ 1.1
Jet Fuels	199	218	230	225	217	183	+18.6	154	+18.8
Lubes	155	165	165	160	161	160	+ 0.6	155	+ 3.2
All Other	1,189	1,290	1,439	1,325	1,310	1,226	+ 6.9	1,150	+ 6.6
Total Demand	10,247	9,044	9,031	10,294	9,664	9,237	+ 4.6	8,781	+ 5.2
Crude Runs	8,240	8,087	8,229	8,350	8,230	7,957	+ 3.4	7,480	+ 6.4

*PETROLEUM PROCESSING Forecast
**Estimated

Refiners' Stocks, Principal Products, By Quarters 1956-1957

(In 1000 bbl)

	1955	1956				1957***			
	Dec. 31	Mar. 31*	June 30*	Sept. 30**	Dec. 31***	Mar. 31	June 30	Sept. 30	Dec. 31
Gasoline	165,400	199,700	177,100	175,100	186,000	211,000	186,000	173,000	185,000
Kerosine	26,800	17,200	26,100	33,700	27,000	17,000	27,000	35,000	27,000
Dist. Fuel Oil	111,300	60,900	93,800	150,800	122,000	65,000	103,000	156,000	125,000
Residual Oils	39,200	33,000	39,100	47,400	43,000	35,000	42,000	48,000	43,000
Total Above	342,700	310,800	336,100	407,000	378,000	328,000	358,000	412,000	380,000

*Actual Bureau of Mines
**API Data
***PETROLEUM PROCESSING Forecast

000,000 bbl from 1952-55, and are 11,000,000 in 1956. Their estimated expected to increase an additional total of 122,000,000 bbl is considered in line with supply-demand needs, while gasoline stocks are admitted to be top heavy in all sections of the country, except possibly California.

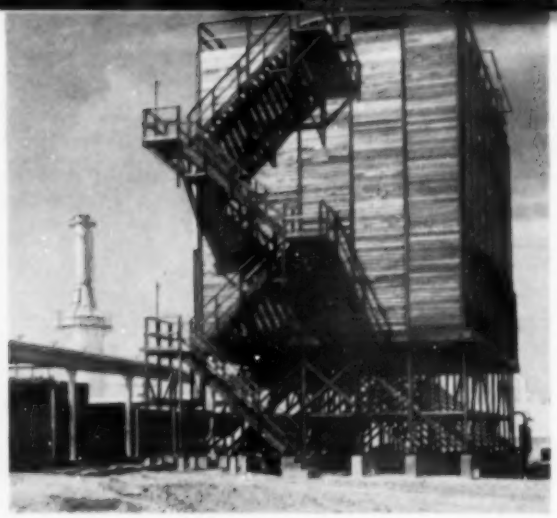
The overproduction of gasoline is reflected also in the trend in average wholesale prices as reported by the Independent Petroleum Association of America. In 1952, the price of motor gasoline was 11.38¢ per gallon tank car at the refinery; distillate fuel oil was 8.52¢. The differential to the refiner was 2.86¢.

In 1953, the price of gasoline was 12.01¢; distillate fuel oil 8.83¢. The differential was 3.18¢. In the first 9 months of 1956, the price of gasoline has averaged 11.78¢, distillate fuel oil 9.41¢. The refiners' differential is 2.37¢. Some refiners consider that manufacturing economics favor distillate when the margin is below 2.50¢. Compared with 1953 prices, the refiner is getting less for his gasoline today, despite the fact he is making an improved product.

To curtail the oversupply of gasoline by reducing crude runs is not the entire answer to the problem. The output of distillate would also be reduced, for which product larger supplies will be required.

One refining authority believes that a small readjustment downward in overall gasoline yields would correct the current overproduction of gasoline, which he estimates is at the rate of around 15,000,000 bbl a year.

OLD TOWER



NEW TOWER

Cooling Tower Changed in Mid-

By RON CANNON, Southwestern Editor

HOW do you change cooling towers in mid-stream without shutting down either plant or cooling water? Here's how Warren Petroleum Corporation made a tricky switch in towers at its Gladewater Gasoline Plant, Gladewater, Texas, this summer—without one minute's circulation loss.

The old cooling tower (above) was an antiquated atmospheric job, vintage 1935. It had performed well for 21 years, but had outlived its usefulness. Evaporation losses were excessive, and maintenance costs were getting out of hand: three carloads of redwood had been installed in the structure in recent years to replace rotting internals. In short, the old tower was worn out. It was time for a change.

Besides getting a new, efficient tower, Warren plant forces point out that they are gaining some other advantages that help justify the $92,000 expense of the complete installation:

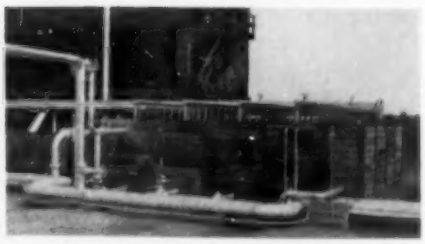
1) The amount of water saving is somewhat of a surprise and a welcome added benefit. Make-up water for the new tower is expected to run about 25% of the former figure—very important in these days of dwindling supplies.

2) Cheaper tower maintenance.

3) Plant maintenance will be a fraction of that with the old tower—cooling tower spray was destructive and corrosive to metals, paints, and buildings. Warren anticipates paint jobs that will last more than a few months now that the source of trouble has been eliminated.

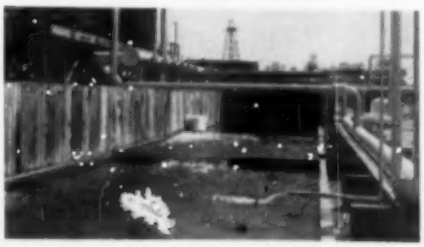
4) Flexibility of cooling tower operations never possible with natural draft air circulation.

General plan for making the change-over was to locate the new tower next to the old one, where many serviceable features of the original installation could be retained:



The old coils are still used

1) Atmospheric coils (above) that cooled some process streams are located throughout the old tower. These coils were to be rearranged and remain in service, cooled by a spray from the new tower.



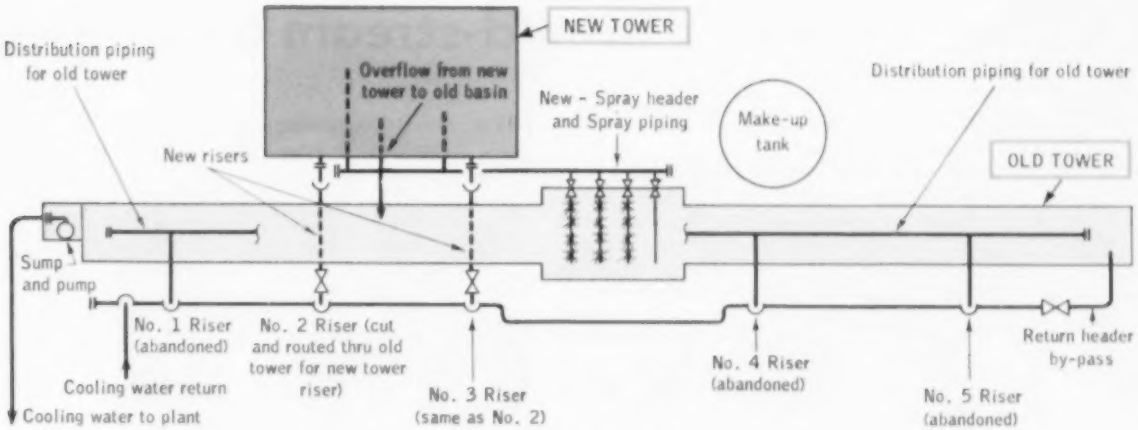
So is the old basin

2) The old basin (above) could be used, thereby eliminating the need for new sumps, pumps, and basin.

3) Existing return piping was to be modified for the new installation.

4) Existing make-up water tank was to remain in service.

The new cooling tower has the same circulating rates as the old—7200 gpm—although it might be hard to prove by physical size. Dimensions of the old job were 18 x 300 ft—the new tower 30 x 50


NEW TOWER
Distribution piping for old tower
Overflow from new tower to old basin
New - Spray header and Spray piping
Make-up tank
Distribution piping for old tower
New risers
OLD TOWER
Sump and pump
No. 1 Riser (abandoned)
No. 2 Riser (cut and routed thru old tower for new tower riser)
Return header by-pass
Cooling water return
Cooling water to plant
No. 3 Riser (same as No. 2)
No. 4 Riser (abandoned)
No. 5 Riser (abandoned)

PLOT PLAN

Stream, Not a Drop of Water Lost

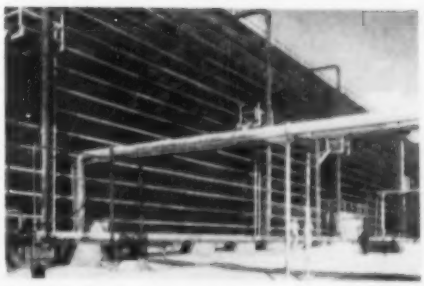
ft. Design conditions are the same: from 102° F inlet water, through a 14° range, to 88° F, or an approach of 10° of the design wet bulb. Two 50 hp induced draft

Two 50hp fans for efficient compactness

fans (above) make the difference in the size of the towers.

Preparation for the switch was the result of long and careful planning by Warren personnel, headed by W. S. McAllister, District Superintendent; E. L. Berry, Plant Superintendent; and Ovid Phillips, Chief Engineer.

First step in setting up the change-over was to arrange suitable return piping to the proposed tower so that the circulation switch could be made without shutting down cooling water. Existing return header to the old water tower was 16-in, with five 10-in. risers to the distribution piping. Because the five risers were primarily for physical distribution, rather than capacity, it was felt that three risers would continue to keep the tower in water and that two



Old piping was modified

risers could be spared for the new return system (above).

This part of the job had to be played by ear; it had to be tried to see if good distribution could be maintained with the three risers. So, two risers selected for returns to the new installation were blanked off under reduced pressure to see what would happen (below). The success of the plan

Two risers were blanked

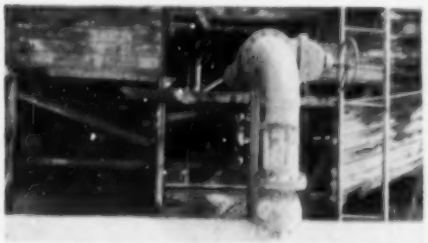
Turn Page For Remaining Steps →

Changing towers in mid-stream (continued)

hinged on the three remaining risers keeping the plant in water.

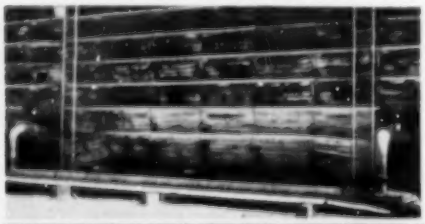
Return header pressure was reduced from the normal 45 psi to about 25 psi, and the bypass into the collecting basin was opened so that the header was held at minimum pressure and flow for normal plant operation. The actual blinding operation (above) on the two pipes took about 20 minutes per riser. No noticeable change in operating conditions or distribution resulted from the reduced circulation—a good sign that the idea was well founded.

These two return lines were then made ready for the new tower. Valves were placed in the lines and the blinds removed. Then the lines were routed through the old tower in preparation for tying into the new tower when needed (below).



Return lines to tower . . .

Further preparations by Warren personnel before erection of the new tower included installing a new spray header (above) that would provide cooling water from the new tower to the old atmospheric coils.



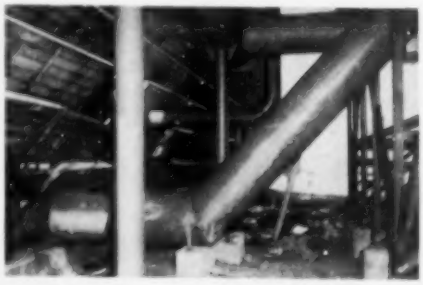
. . . were sent thru old unit

Spray system headers were put in early

Redwood pan is new floor

The narrow space between the installations would complicate the handling of heavy piping after the new tower was built.

In order to use the old basin and coils, the new tower has a redwood pan as its floor (see previous photo). The elevation of the pan was governed by the height of the new spray system. A 16-in. overflow line (below) into the basin keeps the level in the pan at a constant 10 inches.



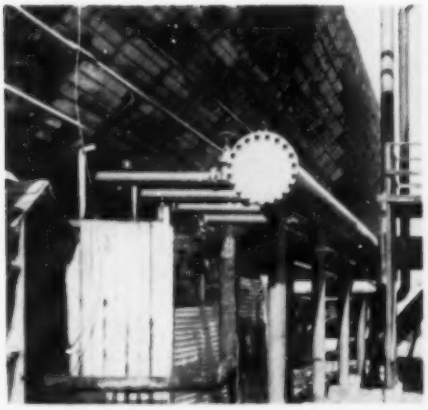
New overflow piping

Overflow goes to old basin

Work proceeded on the replacement tower (above) while Warren forces completed piping and rearranging some of the process streams being cooled in the old tower. One such change was to centralize all atmospheric coils in the tower. The new arrangement would see all coils under a single spray system served by the new tower.

New tower going up

The main process streams cooled in atmospheric coils are lean oil, gasoline, plant air, and hot oil. Old coils at either end of the old basin formerly served all but the lean oil stream. After rearranging the coils,



Spray system is also new

all exchanger cooling at the tower is done at a central location (above) at the middle of the basin. These coils were placed in operation before the old tower was wrecked.

Actual construction of the cooling tower was routine, and work was completed in late July.

Final switching took place on August 1 after the new tower and piping were in place. Because its distribution level is about

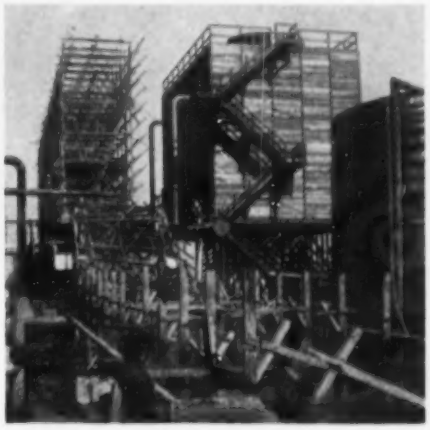
Return risers passed thru old tower

10-ft lower (see above) than that of the old tower, cutting in the new tower involved simply opening valves in the return lines and allowing the new tower to assume circulation. Then, to isolate the old tower meant that the three remaining risers had to be blanked off.

The redwood pan, when full, would hold enough water to keep the atmospheric coils cool for 15-20 minutes. Volume of the basin water was such that plant cooling water temperatures would not rise noticeably over a short period of time. This meant keeping water over the atmospheric coils was the prime consideration—circulation could be reduced only 15-20 minutes at a time.

This proved more than enough time to blank the three remaining risers, one at a time, and process cooling never wavered. The original blinding procedure was repeated each time—return line pressure was reduced and by-passed into the basin while crews broke the flanges and inserted blinds.

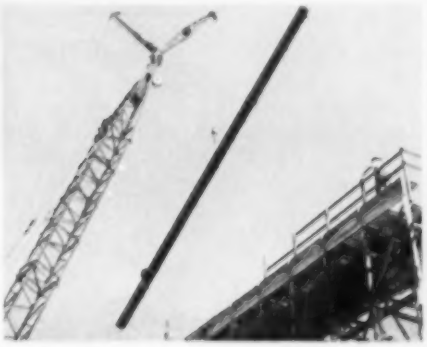
Last phase of the job was dismantling the old tower. This proved to be the tough-



Dismantling old tower

est part of all (above). The 21-year-old structure was so shaky and weak that wrecking was a tedious, painstaking chore. Because the tower would not support any appreciable weight, wrecking crews had to do much of their work from bo'sun's chairs suspended from the top of the tower—and dismantle non-structural parts piece by piece.

Old distribution piping inside and atop the structure had to be cut or broken and lowered in short manageable sections



Old distribution piping coming down

(above). The fire hazard ruled out any burning around the dry tower.

Also, a part of plant improvement was increased electric generating capacity of 205 kw to provide power for the new fans. All work except the actual erection of the new tower was done by Warren plant forces. Tower design and erection was by J. F. Pritchard & Co., Engineers.

The new job, from start to finish, took just over three months. Water was cut in on the new tower on the first of August and the old tower was completely dismantled about one month later.

Decentralized Maintenance Lowers

THE IMPROVEMENT resulting from changeover to decentralized maintenance at National Petro-Chemicals' Tuscola, Ill., plant is quickly seen in the graph above right.

Despite a rapid 270% increase in plant investment, and 23% rise in labor wages from 1953 to 1956, total maintenance costs dropped about 3% during the 1954-56 period (from 10% to 7.2% of plant investment).

The plant started up in July, 1953 with a planned modern centralized maintenance organization of about 100 men backed by a fully equipped central shop.

Since that summer, however, the plant grew greatly. Its size made centralized operations cumbersome. And a shortage of qualified local labor made expansion of the maintenance force impractical. Maintenance costs climbed and efficiency fell off. In mid-1954, after the centralized system had been in operation about a year, costs were reviewed and a definite decision made to reorganize. The goal was a partially decentralized organization closely integrated with the central maintenance group, using area mechanics as much as possible.

Here's what the reorganization meant:

1—Assignment of area mechanics to the six different process areas.

2—Careful selection and training of men assigned to each process area.

This Month's M&C Feature

By C. D. CARNES, Chief Engineer
National Petrochemicals Corp.
Tuscola, Ill.

3—Setting up separate small maintenance shop areas in each of the six different process units and equipping these shops with adequate tools and supplies. Surplus metal buildings and tools from construction were used.

4—Integrating the supervision and daily planning for the area mechanics with that of the central shop for maximum efficiency.

5—Achieving close cooperation between maintenance and production in the use of the area mechanic.

The Background

During the early stages of operation the centralized maintenance system at National Petro-Chemicals worked well despite the many problems of starting a new plant, i.e., green supervision and operating help, errors in process design, corrosion problems, unfamiliarity with the new equipment, etc.

Both maintenance and process employes had been carefully screened before hiring and given a thorough training course so that the best talent in the area was available.

The maintenance force was small and easily coordinated from the central shop. Daily planning meetings were held for the next day's work and a comprehensive job order-cost accounting system was put into effect to accurately analyze maintenance costs.

Construction people were still available on the job site and were frequently used to level out the maintenance manpower peaks.

In time, as the plant expanded, it became evident that maintenance costs were much higher than anticipated, mostly because of continual use of the more expensive construction personnel when National Petro-Chemicals' maintenance men were fully occupied.

More maintenance people were needed, but the area was thoroughly exhausted of available skilled men. Efforts were made to attract skilled workers from other areas. There was little success.

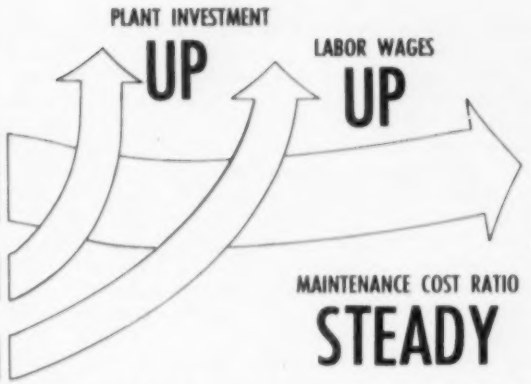
Training courses were accelerated and inexperienced men were hired in limited numbers to be trained for the future; however, they gave little relief at the moment.

Problems

With the increased manpower demand, daily scheduling became more difficult. For example, men were required in certain units on specific jobs every day but, because of the cen-

The Cost Picture at National Petrochemical:

	1954	1955	1956
MAINTENANCE COSTS (MILLIONS $)	2.26	2.22	2.65
% OF PLANT INVESTMENT	3.74	3.36	3.38
PLANT INVESTMENT (MILLIONS $) STARTUP, JUNE 1953 = 39.1	60.6	66.0	78.5
% OF LABOR WAGE INCREASE APRIL 1953 = 100	110	116	123



THE PLANT INVESTMENT-MAINTENANCE COST RATIO IMPROVED SHARPLY WHEN NATIONAL PETRO-CHEMICALS CHANGED OVER TO DECENTRALIZED MAINTENANCE

Costs at National Petro-Chemicals

tralized system, they had to be first scheduled out of the central shop and assigned to the area maintenance supervisor for rehandling and specific work assignment.

National Petrochemicals' plant covers nearly 500 acres and its units are widely separated. It took the men considerable time to get to their assigned work. Also, overlapping supervision sometimes caused difficulties between foremen and area maintenance supervisors, and caused confusion among the workmen, who sometimes didn't know for whom they were working.

The 30-minute small emergency job under the centralized system was a problem, sometimes disrupting planned jobs and pulling men from distant units to handle trivial but emergency work. The displeasure and anguish of the Production Department supervisors who lost their planned maintenance crews also had to be considered.

Under the centralized maintenance system, the area maintenance supervisor was required to schedule manpower for preventive maintenance as well as for routine repairs or breakdowns.

Many times, preventive maintenance was neglected when the available manpower was assigned by the central shop to the seemingly more urgent current maintenance.

Each production unit at the National Petro-Chemicals plant is made up of a variety of mechanical equipment including pumps, compressors, turbines, gears, motors, etc.

For the most part, each of the six production units has quite different equipment. This meant that each mechanic assigned from the central shop very seldom worked on the same mechanical unit and thus was not able to gain quickly the experience and know-how that comes with repeated attention to a few selected items of equipment.

After reviewing costs and deciding on reorganization, management decided to make the change over a period of six months to a year.

Additional maintenance manpower was required at once and all additional maintenance people at the time of the change were to be of the area mechanic type and, therefore, were assigned to each production unit in predetermined numbers as hired.

Many applications had been received from mechanics of this type who had previously been turned down because they lacked well-rounded skills in one of the trades. These applications were reviewed again and the more promising selected for hiring. Also, farm hands were available in the area with "jack of all trades" experience ideally suited as trainees for area mechanic work.

These men were hired as quickly as

About National Petro-Chemical Corp.

National Petro-Chemicals Corporation's plant is located on a 460-acre plot near Tuscola, Illinois, midway between St. Louis and Chicago. The corporation is a 60-40 partnership between National Distillers Products Corporation and Panhandle Eastern Pipe Line. Panhandle supplies natural gas as the prime raw material for the operation.

The newly constructed plant went on stream during the summer of 1953 manufacturing alcohol, LPG, ethylene and ethyl chloride. Since 1953, polyethylene and anhydrous alcohol manufacturing facilities have been added plus expansion of existing plants.

Currently, further expansion is in progress on most of the existing plants and utilities. National Petro-Chemicals Corporation now employs about 750 people. Of this total, more than 500 are hourly employees, half maintenance, half production.

possible and assigned to specific areas, as were certain mechanics within the maintenance organization with talents suited to area work.

As the area mechanics were assigned, the construction tradespeople were gradually eliminated from the maintenance picture except for turnarounds where large amounts of manpower were required for short shutdowns.

Area mechanics were assigned under the administration of the Production Department, but took their work assignments from the area maintenance supervisor who, in turn, reported to the maintenance superintendent.

Area mechanics were further tied to the Maintenance Department because major work assignments done in any unit by this group were planned on a daily basis along with the regular maintenance planning.

Work areas were set up in each production unit, usually consisting of quonsets left over from construction, equipped with hand tools, warehouse supplies and including a welding machine, drill press, pipe threader, etc., most of which were surplus from the construction program.

Equipment and tools in the central shops were also available to the area mechanics as required.

The criteria for assignment of area mechanics to a given area was simple —no more men were assigned than required to do the minimum amount of daily maintenance. Thus, the increment between minimum and maximum was handled by the reserve manpower from the central shops, as determined by the daily planning sheet.

A training program was instituted to inform production and maintenance supervisors of the purpose and functions of the new group. In addition, all new men hired were given a training course to familiarize them with general maintenance procedures.

Trade courses, given after normal working hours, were also made available to the area mechanic group on a voluntary basis.

Decentralization Results

1—Area mechanics assigned to one process unit became more familiar with its equipment and, thus, repairs were made more quickly and efficiently.

2—No time lost in moving from central shop to area for work assignment, because area mechanics reported directly to their units. Men could be quickly shifted about within units with the shifts of daily maintenance.

3—No waiting required for men from central shops on the small emergency jobs. Usually these could be quickly and effectively accomplished by men at hand with no disruption of central shop planned maintenance.

4—Area mechanics, working for one area maintenance supervisor, seemed much better satisfied than under overlapping supervision.

5—Added flexibility was gained by having area men proficient at more than one type of work. Also, the men generally seemed proud of their ability to perform more than one function.

6—More satisfied Production supervisors, who knew they had manpower available when needed for emergencies. There was, therefore, less friction between Production and Maintenance over manpower allocation.

7—Preventive maintenance got scheduled attention from men assigned in the area and familiar with unit problems. Housekeeping improved as men acquired unit pride and worked as a team.

Cost Improvement

The chart on p. 45 shows the cost trend of maintenance compared to the increase in plant investment.

From startup in July 1953 until April 1956 the wages of maintenance workers increased 23%. The costs of maintenance materials increased a like amount.

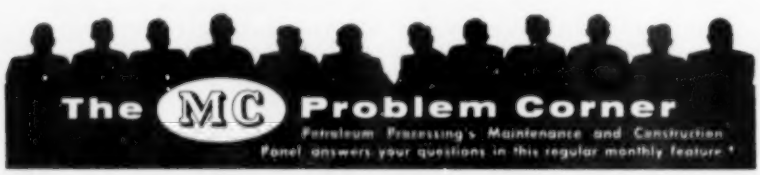
The National Petro-Chemicals plant increased greatly in investment, and many maintenance men were added to keep up with the expanded facilities. Yet the total cost of maintenance in 1955 was less than the total cost in 1954 and the predicted total maintenance cost for 1956 now appears to be only 19% higher than that in 1954.

National Petro-Chemicals does not attribute all of the improvement to the reorganized area mechanic system, nor can the precise saving be measured in dollars, but certainly a large portion of the improvement can be accounted for by the reorganized maintenance system.

Meet the Author

Mr. Carnes

Mr. C. D. Carnes, Chief Engineer, National Petro-Chemical Corp., Tuscola, Ill., was born in 1912 at North Warren, Pa. He graduated from the University of Houston in 1943 with a B.S. degree in Mechanical Engineering. He worked for Shell Oil Co. for 16 years, starting in 1935, at the Houston, Texas, Montreal, and Wood River, Ill., refineries, where he held positions of draftsman, time-keeper and clerk for maintenance, zone maintenance engineer, construction engineer and project engineer. He joined National Petro-Chemicals in 1951 as assistant chief engineer during the building of the Tuscola facilities. He received his present position, in charge of engineering, maintenance and construction, in 1955.


The MC Problem Corner
Petroleum Processing's Maintenance and Construction Panel answers your questions in this regular monthly feature

Clean Towers Chemically?

How satisfactory are chemical cleaning methods for fractionating towers; when can it be done; and how is it done?
Refining, Gulf Coast

CHEMICAL CLEANING of fractionating towers is relatively satisfactory and is often justified economically—though not always. Each cleaning problem must be evaluated individually to find the best solution.

The use of chemical agents to remove deposits from internal parts of fractionating towers has been used satisfactorily in many plants for a number of years, and often has definite advantages over mechanical methods.

Mechanical cleaning of towers can

be slow, tedious and expensive. Sometimes it is impractical to try to remove internal deposits by hand, because they often adhere in almost inaccessible areas.

Some general advantages usually true for chemical cleaning, in contrast to mechanical cleaning, are smaller manpower needs, less breakage of bubble caps and chimneys, and greater speed.

Best economy in chemical cleaning is found when the user can find a rapid and effective procedure to replace the recurrent, routine mechanical cleaning of regularly recurring deposits. Then, savings in both cleaning costs and down time can be realized.

Likely prospects for chemical cleaning are partially coked fractionation towers (but real coke still has to be removed mechanically), deoiling or removal of tarry deposits and sulfide deposits, routine cleaning of soluble deposits from fractionation or absorption towers in light ends service, and bubble tray towers in general.

While no magic is involved in chemical cleaning, it does require a great deal of technical skill and know-how. It's best to consult with someone having experience in such cleaning problems to prevent wasting expensive chemicals and time, and possibly damaging the unit being cleaned.

Contract cleaning services for refineries are considered desirable by the Panel Members answering this question—or at least the use of cleaning materials, technical advice and the assistance of a competent, experienced supplier.

There should be at least one engineer on the staff with a good basic knowledge of the chemistry of cleaning, who appreciates the advantages to be sought in chemical cleaning. This engineer will coordinate the chemical cleaning activities, so he should also know the equipment, materials, and hazards of improper use of chemical cleaning.

Preparation for Cleaning

Chemical cleaning is done usually with the tower out of service, although some in-service cleaning methods have been successful.

There are many sides to the problem, each varying with the type of fouling deposit, design of equipment, and facilities for disposal of cleaning wastes (both liquid and gas).

The would-be user of chemical cleaning must not allow the degree of plugging or deposit to progress so far that effective liquid circulation from the top to the bottom of the tower is not possible.

The first step is to determine what type of deposits are to be removed from the tower. Next, it must be determined whether these deposits can be dissolved by the cleaning agent (or washed out) without damaging the tower internals and packing.

It is best to have an average sample of the expected deposit (from a previous shutdown) so that it can be analyzed in the laboratory to find which cleaning agent will be best for the specific situation. If a refiner is not prepared for this analysis, there are several reputable organizations that furnish this service in connection with their sales of chemical cleaning agents.

Cleaning the Tower

The usual chemical cleaning method for a tower is to pump the cleaning solution to the top of the tower, and let it flow across the trays (or through the packing) and the downcomers, until the solution exits at the bottom of the tower. This procedure permits the use of a relatively limited volume of cleaning solution.

Important considerations are cleaning solution circulation rate, solution strength and tower agitation. Balance of these factors is usually a matter of judgment from trial-and-error experience, or from hiring experience of firms specializing in this type of work.

As the cleaning solution contacts the deposit, it may act in one of two ways: 1) it can react directly with the deposit, dissolving it, or 2) it can react with the binder holding the deposit, thus loosening the insoluble portions of the deposit so that they can be washed out of the tower.

Cheapest chemical cleaning is possible when the cleaning solution reacts directly with the deposit. This usually allows the use of a slow solution circulation rate and a simple waste disposal system.

Higher circulation rates are needed if the solution's chemical reaction is limited to the binder, allowing the undissolved (but loosened) particles to be washed out of the tower. Disposal and separation of solids from liquids and gases, in such a situation, is a bigger problem than when the solution reacts directly with the deposit.

A typical procedure for chemical cleaning of towers is shown in Fig. 1. The tower is taken out of service, depressured and drained. All nozzles except the reflux entry and the bottom drain are blinded off.

Cleaning material is then diluted to the prescribed concentration, and pumped into the tower top through the reflux line, with the solution flowing downward to contact the deposits in the tower.

The solution pump should have adequate capacity for the desired circulation rate, and might have to be of

(Continued on p. 66)

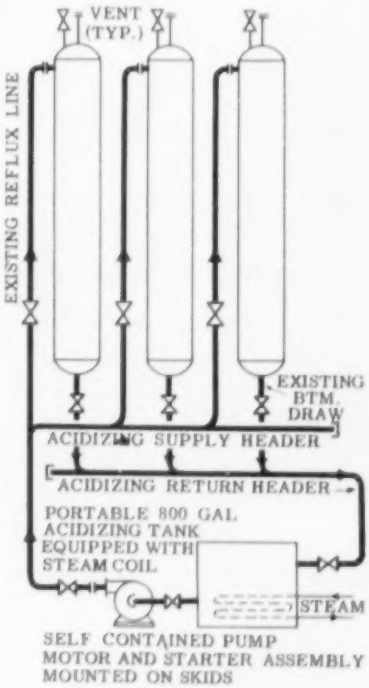
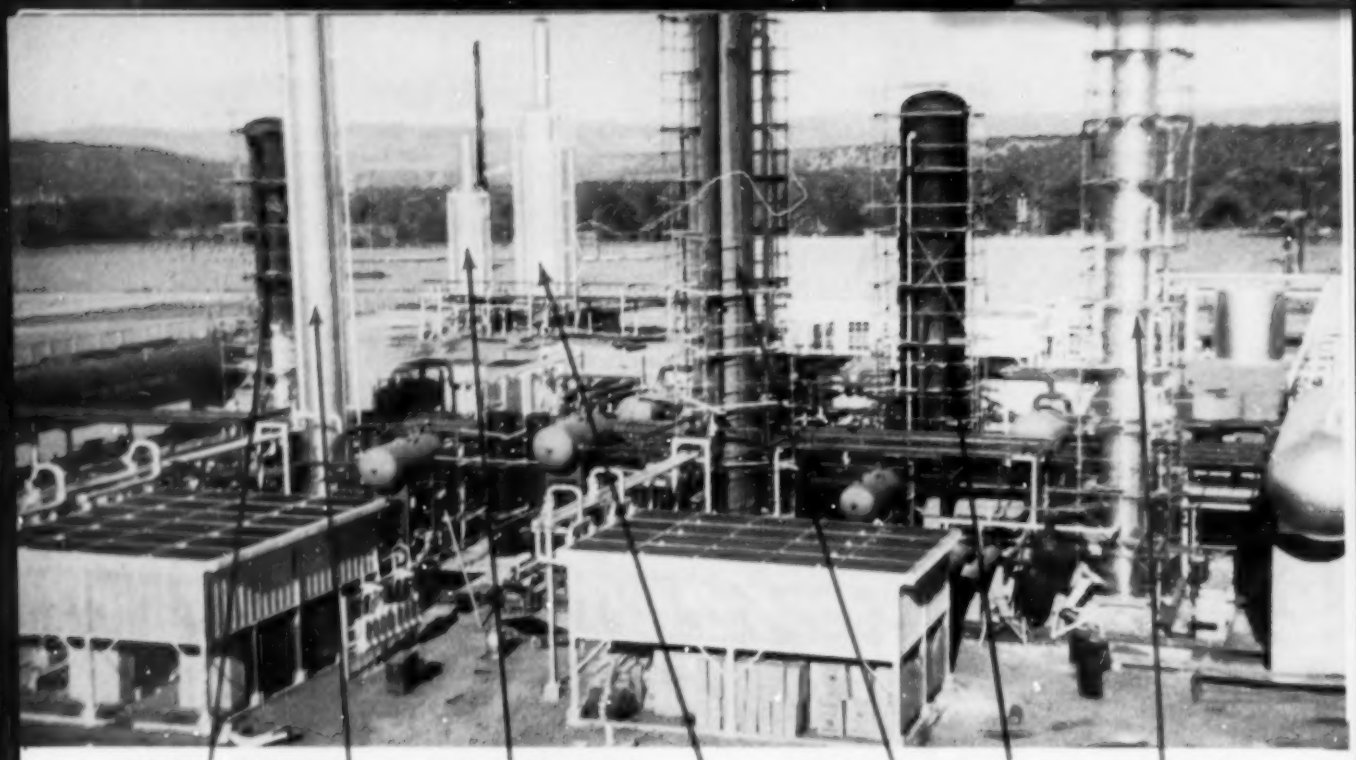

VENT (TYP.)
EXISTING REFLUX LINE
EXISTING BTM. DRAW
ACIDIZING SUPPLY HEADER
ACIDIZING RETURN HEADER
PORTABLE 800 GAL. ACIDIZING TANK EQUIPPED WITH STEAM COIL
STEAM
SELF CONTAINED PUMP MOTOR AND STARTER ASSEMBLY MOUNTED ON SKIDS

Fig. 1—**TYPICAL** acidizing hook-up for chemical cleaning of fractionating towers

Got a Problem?

Why not send it to the M&C panel. Your questions should be specific, and on maintenance and construction. Include a sketch of photo if needed. But please limit each question to one subject. Address them to:

M&C Editor
PETROLEUM PROCESSING
330 West 42nd Street
New York 36, N. Y.



Conventional, but BIG

By RON CANNON
Southwestern Editor

IN FACT—big by any standards. The company's new San Juan gasoline plant was placed in operation in mid-August, along with the line it feeds at the Ignacio, Colo., well-heads of Pacific Northwest Pipeline Corp.'s new 1487-mile-long gas transmission line between the San Juan Basin field and Pacific northwest. It's a giant.

Look at these figures. Design capacity is 300,000 Mcfd of gas. Products at capacity will be: propane, 77,000 gal/day; butane, 98,000 gal/day; and natural gasoline, 70,000 gal/day.

In addition, a field distillation unit ahead of the gas processing plant will process—at full capacity—118,000 gal/day of field distillate from a field gathering system. Wild distillate is topped in this unit to produce 95,000 gal/day of a stabilized product of 6-lb RVP. The overhead from the distillate stabilizer is further processed in the gas plant for removal of propane and butane.

Based on these figures, plant products will total some 340,000 gal/day of liquids, or 1.133 gal/Mcfd of gas charged.

Even at this production, the plant was built for a long-term payout, its immediate purpose is to supply dry gas to the new transmission line serving the Pacific northwest.

Field distillation unit main components are a flash tank and stabilizer column. The 20-tray column operates at 145 psi and 475°F. A direct-fired reboiler heater supplies heat to the stabilizer through a small recycle stream. In addition, the stabilizer receives reflux from the main plant high pressure still, as well as 150 psi stripping steam from the main plant boilers. Stabilizer overhead is introduced into the main plant at the high pressure still reflux condenser.

Gas processing plant is a conventional absorption-fractionation system, using a 40° API absorption oil and steam stripping. Its design is one of simplicty, devoid of frills, but characterized by dependability and versatility.

Inlet plant pressure is supplied by the No. 1 pipe line compressor station, which takes gas from the gathering system at about 450 psig and boosts the pressure to 850 psig. To prevent formation of hydrates at low atmospheric temperatures, the gas is desiccated at the well-heads in a new type calcium chloride dehydrator. These dehydrator units, a development of Fish Engineering Corp., are a departure from conventional units that use a regenerative fixed bed desiccant.

Absorption takes place in four absorbers operating at 825 psig and 95°F. Lean oil is introduced at 80°F. Absorber overhead passes through a residue scrubber that releases dry gas to the transmission line system. As added protection for the transmission system, a full scale dehydration plant is in the sales gas line downstream of the main plant. These dehydrators guard against plant upset, particularly the possibility of water remaining in

. . . That's the San Juan Plant

solution in lean oil, and insure against moisture in line gas.

Rich oil, after picking up any scrubber bottoms, then goes through a high pressure flash tank, followed by the low pressure flash tank. The pressure is reduced beween the flash systems by valves that reduce the pressure from 435 psi, in the high pressure tank, to 180 psi, in the low pressure tank.

Gas from the flash systems is recycled to the gas inlet, while rich oil undergoes a heat exchange with hot lean oil. The hot rich oil is further flashed and passes through a preheater furnace to the high pressure still. Flash tank overhead goes directly to the high pressure still.

Distillation is accomplished in two stills operating in series: a high pressure still at 135 psig and 370°F; and a low pressure still at 10 psig and 350°F. Both use steam stripping. Condensed high pressure still overhead goes into the fractionation section of the plant. Bottoms from this still are further stripped in the low pressure still with a small sidestream going through an oil impurifier where steam is introduced into the stream.

Lean oil is stripped of water in solution, before it returns to the absorbers, by passing heated plant fuel gas counter-current to the hot low pressure still bottoms in a 10-tray dehydrator column. Wet fuel gas is then cooled and condensed water is removed in a condensate separator. Condensed low pressure still overhead joins the high pressure still overhead in the fractionator feed-surge tank.

Fractionation train has the straightforward cascade arrangement of deethanizer, depropanizer, and debutanizer. Vapor from the fractionator feed surge tank is admitted into the reabsorber, at 125 psig, where further absorption occurs, with the overhead from this stage going to fuel.

Overhead from the deethanizer is recycled into the incoming gas charge line through recompressors, or sometimes flared.

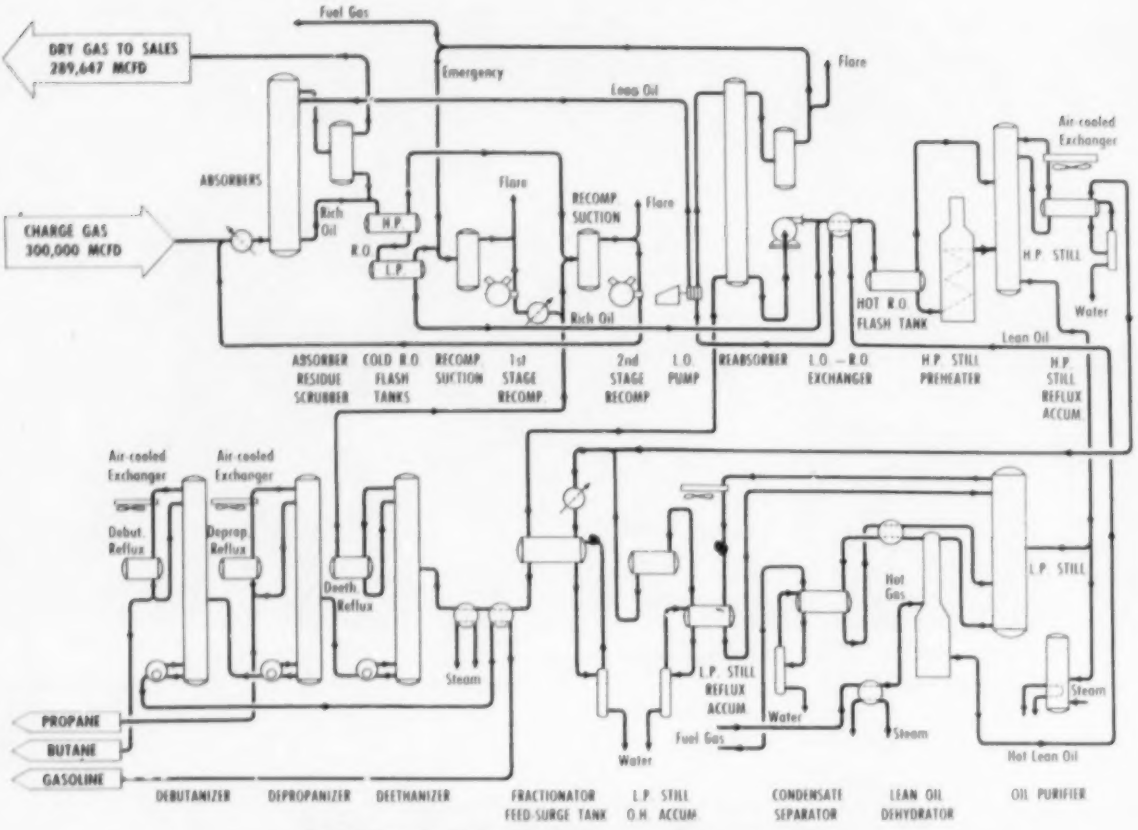
Fuel gas is supplied in two separate systems: high pressure fuel, at 70 psi, for the recompressors, generator engines, and the No. 1 pipe line compressor station; low pressure fuel gas, at 20 psi, for gas plant boilers and heaters. Fuel gas is received from the reabsorber residue scrubber and from the overhead of the condensate separator, which follows the lean oil dehydrator.

Product storage facilities for propane are ten 10 ft O.D. by 65 ft long horizontal storage tanks, design pressure 250 psig at 125°F. Butane is stored in two 40 ft 6 in. diameter Hortonspheres, design pressure 85 psig at 125°F; gasoline storage in two Hortonspheres, 40 ft, 6 in. diameter, 85 psig design pressure. Topped distillate is stored in two 5000 bbl vertical storage tanks.

An 8 in., 350-mile line, now under construction, will transport plant products into the Salt Lake City area. Products will also be shipped out from a 4-bay truck loading dock adjacent to the plant.

Cooling is about evenly split between shell and tube coolers and air-cooled finned tubes. Water from the nearby Florida River is used for all

■ The San Juan Gasoline Plant



COMPLETE PROCESS FLOW of San Juan gasoline plant

plant water. Heat load on shell and tube coolers is about 50 MM Btu/hr, and is handled in an induced-draft tower having a circulating rate of 6000 gpm, and requiring a make-up of about 150 gpm. The tower operates from a hot water temperature of 88.7° F to 72° cold water, based on a wet bulb temperature of 64°F. Balance of plant cooling, 50 MM Btu/hr, is handled in aerial coolers.

Recompressors are two 440 hp, two-stage compressors, which repressure recycle gas from 120 psig to 840 psig. First stage takes suction at 120 psig from the low pressure cold rich oil flash tank and the reabsorber residue scrubber, and boosts the pressure to 430 psig into the second stage. This stream is joined in the second stage by overhead from both the high pressure cold rich oil flash tank and the deethanizer reflux accumulator. A total of 9287 Mscf/d is recycled to the gas charge line. The system is protected by flare outlets on both stages.

Electric power, at 480 volts primary voltage, is furnished by three 600 kw generators. The generators are powered by gas engines.

Steam requirements for the plant are met by three 25,000 lb/hr boilers. Top steam pressure is 325 psig.

Instrumentation and control is simple and uncomplicated. Straight-forward level and flow controls predominate in plant process control. Emergency shutdown controls at various points throughout the plant provide a method of dumping the unit in an extreme emergency. These controls are pneumatic and will, in sequence, shut down fuel gas, charge gas, and at the same time flare the unit for safe, fast shut down.

The high pressure preheater furnace control is typical of plant instrumentation. Normal control of the furnace is by means of a temperature controller at the heater outlet that regulates fuel gas to the furnace. However, an emergency shutdown on this furnace operates from two other points: either a high stack temperature or low outlet oil pressure (indicating a split or plugged tube) will by-pass the oil around the furnace and shut off fuel gas.

Plant construction timetable governed design of process and controls: the plant *had to run* when the Pacific Northwest line was completed and ready for operation.

Fish Engineering Corp. of Houston, Texas, faced with the design and construction of a plant in record time, chose to stick to proven design and simplicity of construction and operation—there was no breaking-in time.

Plant location posed a tough problem in the erection of the absorbers. Rail service was not available, so all equipment had to be trucked to the site. The absorbers, 90 in. I.D. x 56 ft high, were too large for trucking. It was necessary to ship the towers to the site in sections. There, they were assembled, stress-relieved, and erected in place.

Construction began in the summer of 1956, with a completion date scheduled for no more than 12 months later. Start-up personnel from Fish were on the site in mid-August of this year when the first gas was sent through the new transmission line to the northwest. Initial operation was completely uneventful.

Charge rates for the first year are expected to be about 200,000 Mcfd, gradually increasing as the big transmission line comes up to full capacity.

Faster Tank Fire Fighting

FOR FASTER ACTION against a tank fire, Shell Oil Co. safety personnel have developed the new technique shown here. It uses a plastic "window" and a portable hook-shaped foam tower.

Developed by Louis J. Grossheim, manager of the fire and safety department of Shell's Deer Park, Texas, refinery, the technique does this:

1—It eliminates the need for the conventional permanent type installation of one or more foam mixing chambers atop the tank plus the usual foam feeding manifolds and piping.

2—It provides flexibility in fire protection. The portable foam tower can be put in action in minutes.

Grossheim's window, called a "puncture plate," consists of a piece of durable plastic stretched over a rectangular flange at an opening in the tank roof. It measures 42 by 36 in.

Here's how it works. If a fire breaks out in a storage tank, a fire-fighting crew comes in close to the tank on the windward side and raises the foam tower. Then, the men lower the tower so that the hook end drops down and the foam outlet punctures the plastic window.

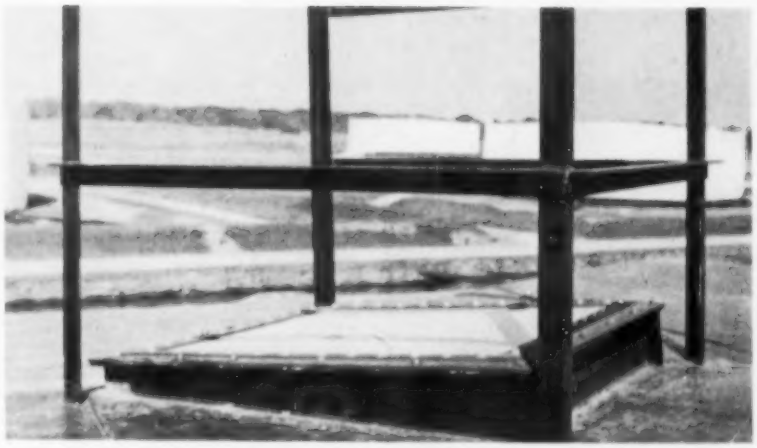
The Shell safety engineer said the cost of using this puncture plate is less than half the initial costs for installing the standard foam mixing chamber. In addition, the puncture plate drastically cuts inspection costs.

Although the new tank fire fighting scheme has not yet been used under actual fire conditions, Shell is well satisfied and has installed the puncture plates on five new tanks, getting an extra benefit—a new means of tank purging.

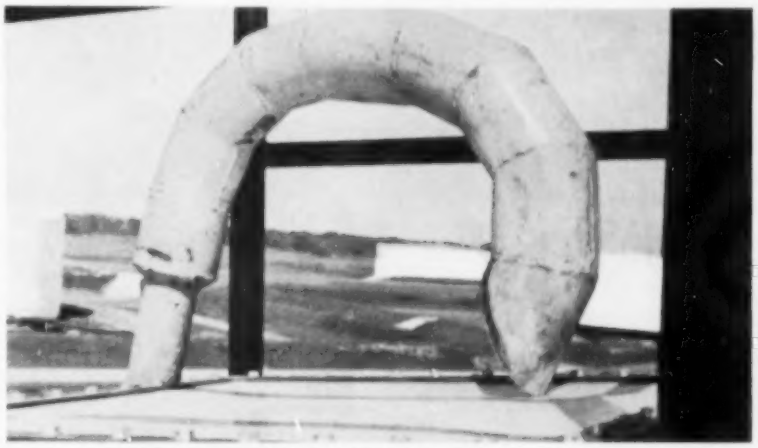
In the past, tanks were purged by injecting steam into the bottom to heat and expel any gas that had accumulated inside the tank. This practice proved hazardous, however, causing explosions at least twice.

More recently, the most popular methods of removing gases from tanks involved 1) cutting metal plates out of the roof and letting the tanks sit overnight, or 2) using steam or air aspirators to pull out the gases.

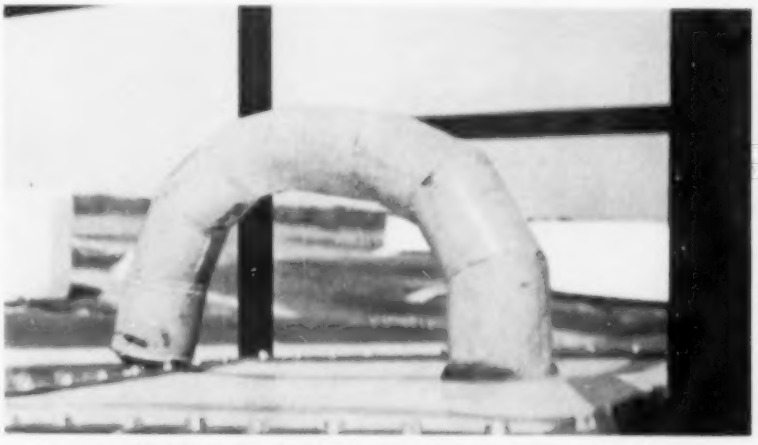
In two recent tests with the puncture plate on the largest tanks at Deer Park—250,000 bbl each, Shell engineers found they could have complete natural ventilation by removing the plastic windows and all manway openings from the tanks and letting the tanks sit overnight.



PLASTIC WINDOW over rectangular opening in tank top replaces usual foam mixing chamber



PORTABLE FOAM APPLICATOR with self-contained mixer is positioned over plastic window



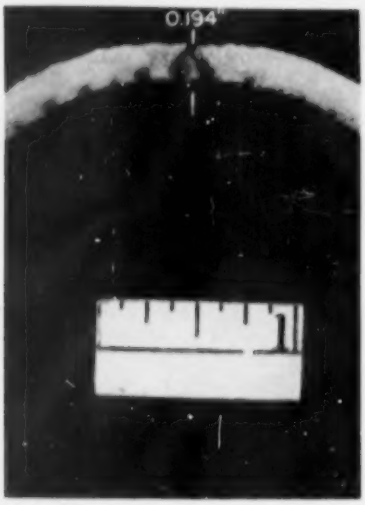
WINDOW IS PUNCTURED by sharp outlet as applicator is dropped into final position

Choosing Metals for the Refinery

By JOHN J. B. RUTHERFORD
Babcock & Wilcox Co., Beaver Falls, Pa.

THE "MIRACLE METAL" for refineries and petrochemical plants —one that embodies all the desired qualities of strength, corrosion resistance, cost and fabrication—is still to be found. Despite recent advances in metallurgy and fabricating techniques, the refinery designer must still choose his materials largely from the known steel alloys. Design of equipment must take into account all types of failure, including the possi-

Guilty of CHEMICAL FAILURE

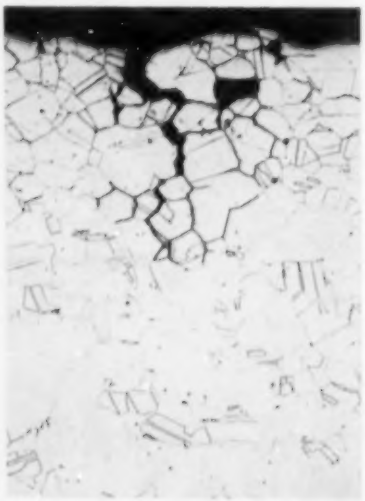


Material: Croloy 7
Service: Heavy oil heater tube
Failure: Wall thinned by scaling; inside surface was carburized and brittle. Cracks generated through the wall from the inside after 43 days.

Material: Steel
Service: Oil heater tube
Failure: Structure changed to ferrite and graphite after 17,000 hours, at a metal temperature of 1000°F.

Material: Croloy 5
Service: ?
Failure: Excessive scaling after 6½ years. Rupture started in a notch formed by a crack in the scale.

Material: Type 347 stainless steel
Service: Cooling coil in T. C. C. kiln
Failure: Stress corrosion. High concentration of salts combined with extreme thermal shock, alternately carrying water or steam at 475°F.



Material: Type 310 stainless steel
Service: Sulfur boiler
Failure: Intergranular corrosion from concentration of salt water in crude sulfur.

Material: 25Cr-12Ni
Service: Cast tube hanger
Failure: Deposition of vanadium pentoxide (ash) from fuel oil. Because of low melting point of this ash, it fluxed off protective surface layer and permitted rapid wastage.

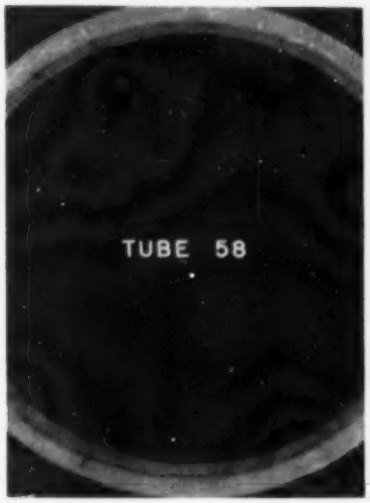
bility of improper operation, unknown process variations and unavoidable emergency conditions.

That some of the metals now being used cannot be "all things to all men" is vividly demonstrated by the "rogue's gallery" on these pages of metal equipment pieces that have been guilty of poor behavior. These were all well designed pieces, but experienced some unanticipated condition. Until some kind of miracle metal is discovered that will meet all operating and design conditions, successful equipment for processing will continue to depend on careful selection of the metal, proper fabrication, standard operation and vigilant periodic inspection and maintenance.

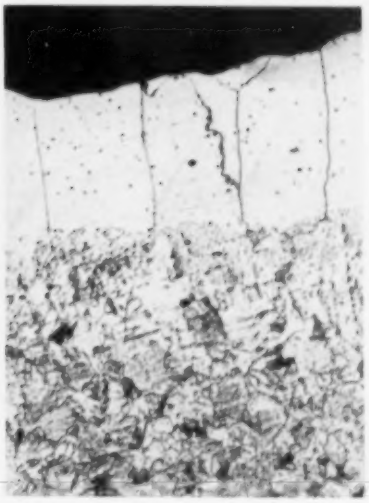
This display of common failures in refinery equipment indicates the variety of possible causes and types of failures. Almost all of them can be overcome by proper design—or by strict control of operations and proper maintenance inspection. Most of the scaling and chemical attacks can be reduced (but not eliminated) by the use of higher alloys or operating temperatures. But some, like the attack by vanadium pentoxide, sodium salts, or hydrogen, are not solved so simply.

However, if the operating and maintenance departments know why the designer selected certain metals for the fabrication of the equipment

Guilty of MECHANICAL FAILURE



Material: Type 410
Service: 1800 hr at 1300-1500°F, heater tube
Failure: Quench cracks generated throughout the inner surface, which was carburized after periodic coke burnouts.

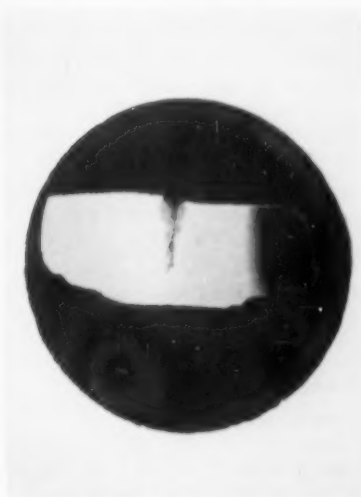


Material: Croloy 5
Service: Reformer tube after 56,000 hours
Failure: Oxygen diffusion through the outer decarburized layer, creating directional properties of outer layer.

Material: Croloy 5
Service: Heating oil at 740 psi, 950° F. heater tube
Failure: Brittle high temperature failure after 49,000 hours. Attributed to a period of severe operation above 1200°F.

Material: Croloy 5
Service: Naphtha reforming furnace tube; 240 hours
Failure: Ductile high temperature failure. Localized area was carburized (probably at 1700°F), and swelled before rupture.

Material: Croloy 1¼
Service: Cooling coil, thermofor kiln
Failure: Thermal fatigue; oxygen diffusion and thermal variations from 460°F to 1050°F caused rupture at columnar grain boundaries.



Material: Type 310
Service: Gas reformer, steam and methane, pipe weld
Failure: Accelerated oxidation in the crack left by the poor fusion weld. Space catalysed oxidation at 1450-1650°F.

pieces, these departments can aid greatly in obtaining maximum safe operation of the equipment.

Steel Is the Basic Material

The major component of all processing equipment in the oil and petrochemical field is steel. It is still the cheapest material that provides the desirable qualities for fabrication and operations. As present-day processes become continuous, and operating conditions become more severe, it is essential to appreciate the limits of the materials in use, as well as why they were originally selected.

The basic steel used for refinery equipment is: (1) low in carbon content, (2) contains residual quantities of phosphorus and sulfur, and (3) has manganese added to offset the effect of the residual sulfur. It may also contain small quantities of silicon or aluminum added as deoxidizers to obtain a homogenous material.

To this basic low-carbon steel may be added other metals to obtain special characteristics related to strength (at various temperatures), toughness, magnetism, corrosion resistance, machineability, or weldability.

Choosing the Right Metal

The starting point for selecting metals to be used in processing equipment are the standards that are based on years of experience, and which represent the best cumulative knowledge. Typical of these standards are the specifications developed by the American Society for Testing Materials (ASTM). They represent the combined knowledge of the producer, the user, and general interest groups such as the safety code and insurance underwriters.

All of the steels used seem to satisfy special requirements:

- Carbon steel is the cheapest and most versatile of the wrought products.
- Nickel steels are used for extra low temperature service, such as that found in dewaxing.
- Austenitic stainless steels are used for still lower temperatures in liquefying oxygen and nitrogen.
- Chromium - molybdenum alloys have been developed as an intermediate for service between ordinary steel and the austenitic stainless steels.

The more common of the chromium-molybdenum heat resisting alloys are illustrated in Table 1.

Today the basic material of construction is low carbon open-hearth steel. A carbon content of under 0.3% is generally maintained to simplify welding and permit using plate products in the hot rolled condition. However, still tubes, heat exchanger tubes and pipe are supplied in the annealed or soft condition in order to be suitable for welding, expanding into fittings, bending or other fabricating procedures. But even in this soft condition, the material is required to meet minimum strength requirements, i.e., 60,000 psi tensile strength and 30,000 psi yield strength.

For high temperature service and corrosion resisting service, numerous alloys have been developed. But because the same methods of fabricating are used, these alloy steels are also annealed to the same strength properties as the unalloyed. This need for a soft, stress-free material restricts the use of the alloy steels from the higher strength conditions of which they are capable. However, new fabricating methods and operational procedures are changing this picture. The equipment designed for coal hydrogenation and polyethylene manufacture, for example, has permitted the use of steel tubing with yield strength properties of two to three times the conventional product.

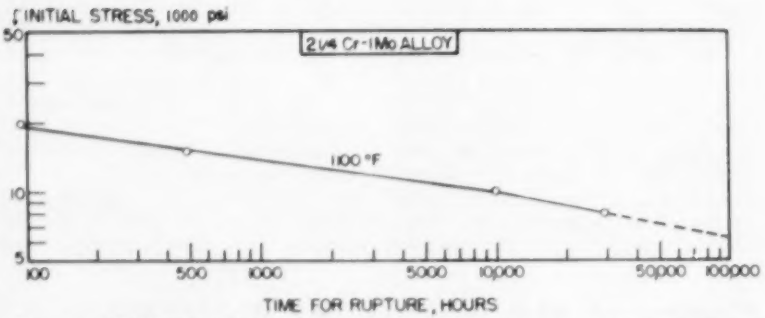


Fig. 1.—**INFLUENCE OF TIME** on the rupture load for a high temperature alloy steel

Mechanical Strength of Metals

The maximum design stress for steel and many alloys has been codified by the ASME and the API. Design at ordinary temperatures is based on tensile strength or yield strength based on the elastic formulae found in engineering handbooks. At higher temperatures, where steel behaves as a plastic, the stress allowance is related to a creep rate, or the load-causing rupture in a period of 100,000 hours. (This period compares to life expectancy of about 10 years for industrial equipment.)

Table 2 shows how the design strength of carbon steel, Grade B, drops at higher temperatures. Data are limited to 1100°F because the rate of scaling above that is excessive, and measurements have little value.

At higher temperatures where creep is operative, the stress allowance for piping is sometimes 20% higher than

What These Terms Mean

AISI—American Iron & Steel Institute, an industry organization.

anneal—a method of altering the grain structure of steel by heating above a critical temperature, followed by carefully controlled cooling.

austenitic—a steel composed largely of a non-magnetic, solid solution of pure iron (ferrite) and iron carbide (Fe_3C).

ferritic—a steel containing a large proportion of a pure iron (ferrite) that is very magnetic below 1400°F; very ductile and can be easily cold worked.

open-hearth—a steel making process accounting for most of the steel produced; other methods used are the Bessemer and electric furnace.

wrought iron—a mechanical mixture of very pure iron (ferrite) and silicate **slag**; used in forged or welded pipe, pipe fittings and bar stock.

Table 1—High Temperature Alloys

AISI Grade	% Chromium	% Molybdenum
T1¼	1.05- 1.45	0.45-0.63
T2¼	2.00- 2.50	0.93-1.13
T5	4.00- 6.00	0.45-0.65
T7	6.00- 8.00	0.45-0.65
T9	8.00-10.00	0.90-1.10

the allowance for similar heater tubes. This is because all temperatures refer to metal temperatures, and it is assumed that piping will obtain a gradient down from product temperatures, whereas, in heating tubes and coils the gradient will be up.

Table 3 illustrates the load-carrying capacity of various steels at 1100°F, and are the same steels defined in Table 1. It is apparent that the addition of an alloy increases the strength of steel at this temperature, although it is not a progressive increase. The main contributor to strength is molybdenum, while chromium detracts, although it is added for other purposes. It was over some 25 years ago that molybdenum was added to these particular alloys to prevent brittleness. Only at a later date was it learned that this element materially increased the creep strength.

The influence of time on the rupture load for a typical high temperature steel is shown in Fig. 1. The short-time tensile strength of this alloy at 1100°F is about 39,000 psi. This test required about one hour after reaching a steady temperature. However, over a period of 21 hours, 24,000 psi will cause rupture. Over 30,000 hours, the strength level drops to 8,000 psi. Extrapolation of the values gives a rupture value of 6,000 psi over a period of 100,000 hours. (The value given for this same material in Table 3 is a conservative stress allowance of 4,200 psi at 1100°F.)

Where metals must be selected for a highly corrosive environment at elevated temperatures, the austenitic steels are chosen. Ferritic steels show a rapid loss in strength with increasing temperature above 1000°F. In austenitic this same effect occurs above 1500°F. Table 4 shows the relationship of allowable stresses for some of the austenitic grades of steel. These higher alloy steels obtain a higher tensile strength at room temperatures as well as much greater stress allowances at higher temperatures than do the ferritic steels of Table 3.

The highest alloy, Type 310 (25Cr-20Ni) is assigned much lower values at 1100°F, and then is further differentiated between fine and coarse-grained structures. A 70% difference in stress value seems quite liberal, dependent on whether the grain is size #6 or larger. This situation is unique among stress allowance evaluations at the present.

Stress allowances for tubing are somewhat lower than for piping of the same composition because tubing is generally used in applications involving heat input and the temperature gradient in the metal rises from the product temperature. In piping the reverse is true. Thus, the stress allowance values published by the Boiler and Pressure Vessel Code are slightly lower than those contained in the Code of Pressure Piping (ASA 31.1-1955).

Selecting a Metal for Corrosion Resistance

After designing equipment to meet strength requirements, consideration is next given to the factor of corrosion allowance or metal wastage. Based on a background in water service, standard pipe has a corrosion allowance contained in the formula for calculating threading, pressure and dimensional tolerances. But in order to establish the amount of corrosion, it is necessary to have knowledge of

Table 2—How Temperature Alters Allowable Stress for Metal Pipe (ASTM A106 Grade B)

Temperature	500°F	700°F	900°F	1100°F
Stress, in psi	16,400	14,400	6,500	1,000

(Minimum tensile strength of this alloy is 60,000 psi)

Note: Data taken from ASA B31.1-1955, Code for Power Piping

Table 3—How Load Carrying Capacity of Alloys Vary at High Temperature, 1100°F

Metal	Carbon Steel	T1¼	T2¼	T5	T7	T9
Allowable Stress in psi	1,000	4,000	4,200	3,300	2,500	3,300

Note: Data from ASA B31.1-1955, Code for Power Piping
Numerical number after T repreesnts nominal chromium content.

Table 4—Comparison of Allowable Stress Value for the Austenitic Stainless Steels at High Temperatures

Grade	1100°F	1200°F	1300°F	1400°F	1500°F
304	7,500	4,500	2,450	1,400	750
316	10,400	6,800	4,000	2,350	1,500
321	12,500	5,000	2,700	1,550	1,000
310 Fine Grain	5,000	2,500	750	350	200
310 Coarse Grain	8,500	6,000	3,500	1,600	750

Note: Data taken from ASA B31,1-1955, Code for Power Piping
Coarse grain is size #6 or larger

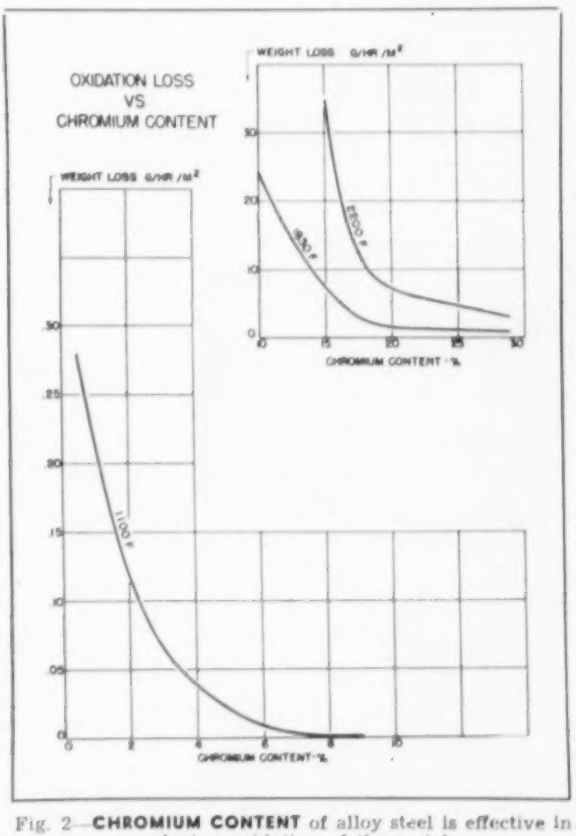


Fig. 2—**CHROMIUM CONTENT** of alloy steel is effective in reducing oxidation of the metal

prior experience under closely related environmental conditions.

Although mechanical strength is dependent on time only above about 600°F, corrosion is time-dependent at all temperatures. The life of all equipment in service is finite and a generous safety factor is normally used to cover operating variables. But even with reasonable precautions, experience has shown that vigilant periodic inspection is required.

In oil refinery service, the most common type of corrosion is oxidation. It is caused by exposing steel over a wide range of temperatures to air, combustion gases, steam and other atmospheres. The result is the conversion of the metal to an oxide that lacks the mechanical attributes of the original material. Another danger is that the oxide will occasionally catalyze reactions in the product or poison a catalyst already in use.

Chromium, when alloyed in steel, is quite effective in reducing the rate of oxidation. The graph in Fig. 2 shows the pronounced effect of this element in reducing the oxidation of many samples exposed to a variety of temperatures and air.

Molybdenum, although it increases creep strength, acts the reverse of chromium. Under exposure to a stagnant atmosphere, molybdenum-containing stainless steels may be subject to catastrophic oxidation wherein a localized area will scale at a rate comparable to a chromium-free alloy.

Vanadium alloys behave in a similar manner wherever an enrichment of vanadium oxide occurs. Vanadium pentoxide has a low melting point and acts as a flux on the otherwise protective chromium oxide layer.

Fig. 3—**ZINC** will penetrate the grain boundaries of stainless steel at high thermal stresses

Because petroleum products are frequently associated with sulfur, it is essential in building a crude-heating furnace to know the characteristics of the crude. This may be more important than the temperature in the selection of the proper metal. For the past thirty years, chromium has been as effective in combatting sulfur attack as it has in combatting oxidation. However, recent developments in catalytic reforming, involving large quantities of hydrogen, have altered its effect. Under these conditions, the low alloy steels necessary to resist hydrogen attack show ready sulfide attack and the chromium content must be raised to 12%, into the stainless steel grades, before any benefit is found. Apparently, the advantages of chromium in these lower alloy steels is only realized when some oxygen is present and possibly when the sulfur exists as an organic compound.

Hydrogen is frequently associated with, rather than the cause of, corrosion. Its main influence is on the mechanical and chemical properties of the metal. The small H atom readily diffuses through the metal lattice, to combine in molecular form at such discontinuities as inclusions and laminations. It also may reduce the oxygen-bearing protective layer on chromium steels and permit unanticipated reactions. It may protect the metal from oxidation but permit traces of oxygen to react with carbon in the metal, leading to decarburization. Hydrogen may also permit carburization in the presence of hydrocarbon by permitting carbon to diffuse into the metal and change its properties. The best resistance to both carburization and decarburization from the presence of excess hydrogen is found in the higher chromium alloys.

Some years ago, stainless steel heater tubes installed in an old furnace to increase its capacity failed from stress corrosion cracking within a few days, before any scaling or visible change occurred. It developed that the fuel oil contained some refuse chlorinated hydrocarbons which, on combustion, generated hydrochloric acid. This came to light when the operator complained of asphyxiation.

Similar circumstances have been reported recently in catalytic reforming equipment during startup. With the equipment in the condition of highest stress, the unit is purged with hydrogen to dry out the catalyst. Moisture and chlorine driven off from the catalyst will strike the furnace before the welds and expansion connections have had an opportunity to relax. The design and operation of this equipment should specify stress relieving all parts and venting the purging gas (hydrogen) out of the catalyst case.

Other Considerations

Some equipment failures may be caused by methods of fabrication as well as by the previously mentioned causes. Fig. 3 illustrates this. It shows a photomicrograph at high magnification of Type 321 base metal adjoining a weld that had been purposely contaminated with zinc. The zinc has penetrated at the grain boundaries in the heat affected zone where thermal stresses are high.

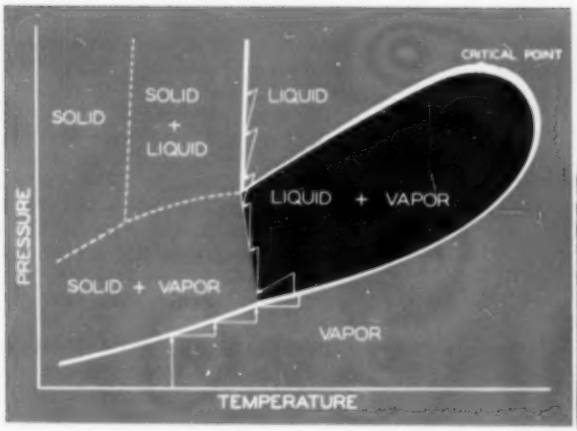
This intergranular penetration shows why steel should not be fabricated for elevated temperature use by copper, brass or bronze tools. Furthermore, precautions should be taken against marking steel parts with paints or pigments containing oxides of these metals.

Often the engineer who must select the type of metal for an equipment piece is influenced by matters outside his own control. At this time, nickel is in short supply, but it is still one of the important alloying elements in the austenitic stainless steels. Thus, these steels for very low and very high temperature uses are difficult to procure. As a result, in gas reforming at temperatures of 1500 to 1800°F, the traditional Type 310 (25Cr-20Ni) is being replaced by Type 302B (18Cr-8Si) or Type 309 (25Cr-12Ni).

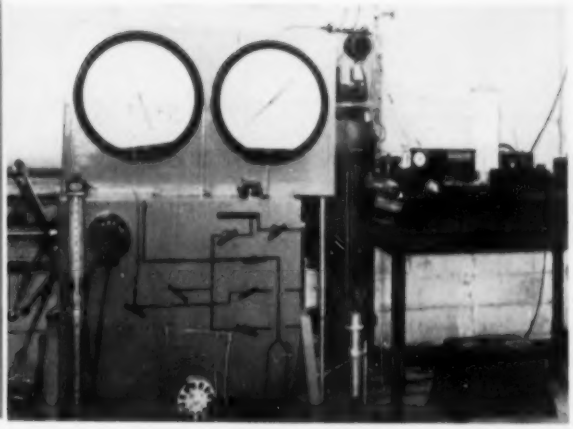
Meet the Author

Mr. Rutherford

John J. B. Rutherford, chief metallurgist of Babcock & Wilcox Co. Tubular Products Division, has been engaged in the development of tubular products for petroleum and chemical use for the last 18 years. Previously he worked as a research metallurgist with U. S. Steel Corp. He holds several patents on the processing of stainless steels. Mr. Rutherford was born in Scotland and came to this country after his formal education at Heriot-Watt College in Edinburgh. He is well known for his active membership in API, AISI, ASME and many other professional organizations.



PHASE STUDY PROBLEMS are solved by this . . .



NEW EQUILIBRIUM test apparatus

Phase Studies Your Problem?

This New Apparatus May Help

This versatile unit provides tests data from −300 F to +300 F

By FRED KURATA, University of Kansas and JAMES P. KOHN, University of Notre Dame

ARE you concerned with the study of phase equilibria and P-V-T relationships? The apparatus that the authors have developed should be of special interest. By the use of glass sample tubes in an equilibrium cell, it is possible to solve such problems as:

- P-V-T measurements
- Vapor-liquid equilibria
- Solid-vapor equilibria
- Solid liquid equilibria
- Solid-liquid-vapor equilibria
- Partial miscibility in a binary system
- Viscosity relationships
- Solid solubility

Because of today's increased activity and interest in low temperature processes, this test apparatus was designed to secure data in the low temperature range, down to —300°F, under pressures up to 200 atmospheres. Although designed for low temperature investigations, the same equipment can be operated without difficulty at temperatures up to 300°F.

The glass equilibrium cells used in the study of volumetric behavior of gases and liquids permits visual observations at all times, although the glass does limit the upper range of pressure. This equipment has been used successfully in various low temperature phase behavior studies where solid, liquid, and vapor phases coexist—or where more than one liquid phase are present. It also permits taking volumetric data concurrently with the phase data. Tests also show that this equipment can be used for viscosity measurements too.

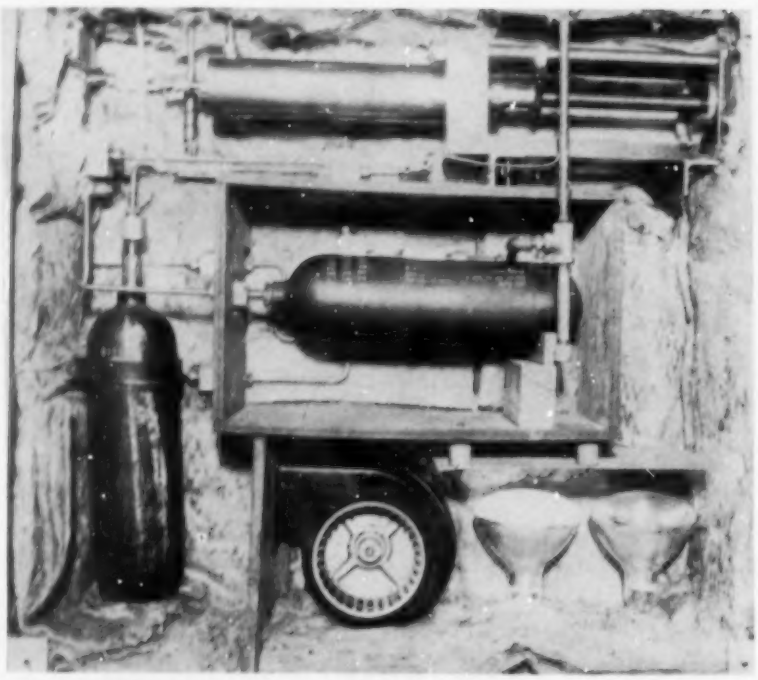
The Test Apparatus

The schematic flow diagram of the testing apparatus is shown on the page at the right. The photo above is a general view. Details are shown in other photos. The two large dials in the general view indicate pressures in the equilibrium cells and the displacement pump.

The compartment that houses the two gas reservoirs, manifold, and displacement pump is made of heavy plywood and insulated on the inside with several layers of fiberglass (see photo). This compartment is maintained at constant temperature by circulating air past the reservoirs and the pump cylinder by means of suitable baffles. The motor on the centrifugal blower is mounted outside the compartment, with the shaft extending inside to actuate the blower impeller.

By this arrangement, an air velocity of approximately 4 fps is induced across the pump cylinder. Air temperature may be maintained at any desired level between room temperature and 300°F by the use of two infra-red lamps. One lamp is controlled by a multi-position bi-metallic thermometer that is sensitive to temperature changes of 0.05°F. The other lamp is controlled manually by a 5-amp variac.

The pump is a manually operated, 100 cc positive displacement pump manufactured specifically for precise displacement of mercury into volumetric apparatus. It has a micrometer scale graduated in 0.01 cc increments, and may be estimated to 0.005. No mercury is used in the pump cylinder, because the plunger is used to directly



TEST EQUIPMENT HOUSING insulates the gas reservoirs and displacement pump from external effects and permits constant temperature control

displace the gas mixture. The pump packing is assembled by spacing neoprene rings alternately between fiber rings. Properly adjusted packing has given leakproof service at high pressures over many months of continuous use.

The gas reservoirs are stainless steel cylinders of 96 cu in. internal volume. One cylinder is used as a high pressure container for the gas mixture under observation. The other cylinder is accurately calibrated volumetrically, and is used only to determine atmosphere pressure corrections when applying the perfect gas law to the gas mixture. The manifold and attendant piping is constructed of standard ¼-in. high pressure stainless steel fittings, valves, and tubing. All lines outside the housing are ⅛-in. small bore steel tubing, wrapped with nicrome wire and insulated with fiberglass. Current is supplied to the wire through a 5 amp variac so that the lines can be maintained at the same temperature as the pump.

The constant temperature bath consists of a glass Dewar flask that is filled with a suitable liquid (see photo). Two unsilvered strips are diametrically opposed so that the equilibrium cell and its contents may be visually observed. The flask fits tightly to the cover plate, which has the dual function of supplying top insulation and supporting the draft tube, nitrogen vaporizer, electrical heating coil, and the agitator magnet. Constant temperature is maintained in the bath by either vaporizing liquid nitrogen or counter-balancing this cooling by controlled electrical heat. By this means it is possible to control the bath temperature to $\pm 0.05°F$.

A horizontal cross section of the bath is shown in Fig. 1. The draft tube is an oval of copper sheeting and extends nearly to the bottom of the flask. On opposite sides of the draft tube are windows of cellulose acetate plastic permitting light from a fluorescent bulb to pass through the bath. The nitrogen vaporizer is a 5-in. length of 1-in. copper tubing. Liquid nitrogen enters the top of the vaporizer through a ¼-in. copper tube; the effluent vapor is discharged through an 8-ft section of ¼-in. copper tubing. The vaporizer and the nicrome heating coil are secured inside the draft tube.

An agitator is mounted coaxially with the draft tube and is located approximately 1 in. above the bottom of it. The impeller shaft extends up through the cover plate and is driven by a small, variable speed air motor.

In operation, the bath liquid is drawn inside the draft tube and passes up around the equilibrium cell. The choice of bath liquid depends on the temperature desired. Kerosene, white gasoline, pentanes, and propane have all been used over the various temperature ranges.

The liquid nitrogen is stored in a 25 liter metal Dewar flask supported on a platform scale. The nitrogen is driven by compressed air to the vaporizer through a siphon tube, with its rate controlled by a needle valve. A pressure regulator and a Cartesian manostat prevent the pressure from building up in the liquid nitrogen flask.

The Equilibrium Cells: Different types of cells are used to confine the fluid system under observation, and all cells are custom blown from high pressure Pyrex gage glass (see photo), with volumetric capacities between 1.33 and 12.5 cc.

These cells are subject to rapid stress aging under high pressures. A 12.5 cc cell usually shows a bursting pressure of 1800 psi or higher. However, the same cell will rupture in about one hour at 1550 psi and within five hours at 1450 psi. But it will last indefinitely at pressures below 1300 psi.

The 1.3 cc cells show rupturing pressures of about 4000 psi and can be used with comparative safety up to 3000 psi. The dimensions of a 5 cc cell that can be used at pressures up to 1500 psi are shown in Fig. 2.

The glass cells are all annealed before use to remove residual strains. Cells that have been maintained at 1100°F for 5 hrs. rarely show strains under polarized light. Because the cell behavior under high pressure is not absolutely predictable, the bath is shielded to protect the observer from flying glass in case of cell rupture.

The cells are graduated for volume before annealing with ceramic ink, which is fired on. All cells are calibrated volumetrically by introducing accurately known volumes of liquids.

The equilibrium cells are joined to the stainless tubing by a device similar to one previously described by Davis, Gore, and Kurata[2]. The seal is effected by compressing a neoprene O-ring, retained in a recessed stainless steel stud, against the ground glass top of the cell. The O-ring extends out of the accurately machined recess 0.015 in. before it is compressed to a finger tight fit. Carefully adjusted seals consistently give good performance under pressures ranging as high as 3000 psi.

How Pressure Is Measured

Pressure measurements above atmospheric pressure are made with

two 16-in. Heise bourdon tube gages. The gage used for cell pressure measurements has a range of 0-2000 psi, graduated in 5-psi increments. The other gage has a range of 0-3000 psi, graduated in 5-psi increments, and is used for pressure measurements in the displacement pump. Dead weight checks of both gages indicate they are accurate to 1 psi at pressures below 800 psi and to 2 psi at higher pressures. Both gages have steel bourdon tubes that are filled with mercury to reduce the volume as well as to prevent condensation of the gases in the tubes. Two open-end manometers are used to obtain low pressure data.

How Temperature Is Measured

Temperatures in the low temperature bath are determined with an Aminco platinum resistance thermometer and a Mueller bridge. The thermometer was calibrated against a Leeds and Northrup platinum resistance thermometer that had been previously calibrated at the Bureau of Standards. The calibration of the Aminco instrument indicated an accuracy within 0.04°F of the International Platinum Scale.

Temperatures within the gas reservoir housing are determined by iron-constantan thermocouples connected to a portable Leeds and Northrup potentiometer. Two thermocouples are attached to the pump cylinder. Another is attached to the low pressure gas reservoir. Three iron-constantan thermocouples are attached to the ⅛-in. steel tubing connecting the displacement pump with the equilibrium cell. A bi-metallic and a mercury-in-glass thermometer are used to measure the circulating air temperature. Temperature measurement within the housing is accurate to 1°F.

Six Determinations The Unit Can Handle

The gaseous system to be studied is prepared by charging the gases into the high pressure reservoir as pure components. The gas reservoir is first evacuated and then flushed with one of the gases to be studied. Then the gases are added in the desired proportions based upon approximate calculations using the perfect gas law and such compressibility factors as are available. The heating lamps are then turned on and air is circulated in the reservoir housing to raise the temperature of the system so that no liquid phase can exist in the reservoir.

The gases mix by molecular diffusion and by convection currents within the reservoir as it is heated. Calculations of unsteady state molecular diffusion indicate that a uniform mixture can usually be attained in the reservoir in less than eight hours. Samples of gas from the reservoir are taken and analyzed to determine the exact composition. Many binary mixture compositions may be readily determined by density measurements. Multicomponent mixtures are analyzed by mass or infra-red spectrometer.

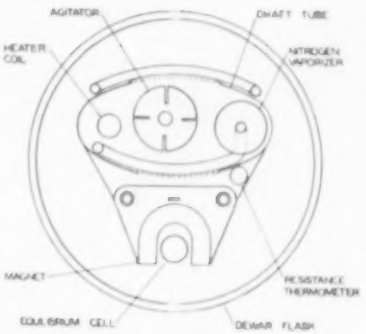


FIG. 1—In cross-section, the constant temperature bath appears crowded with equipment for maintaining close temperature control

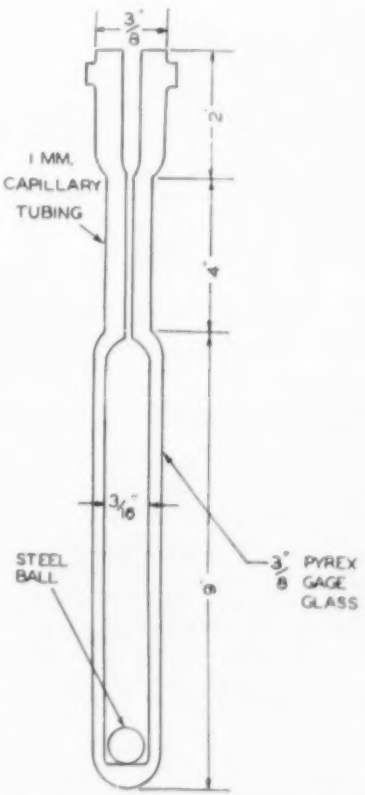
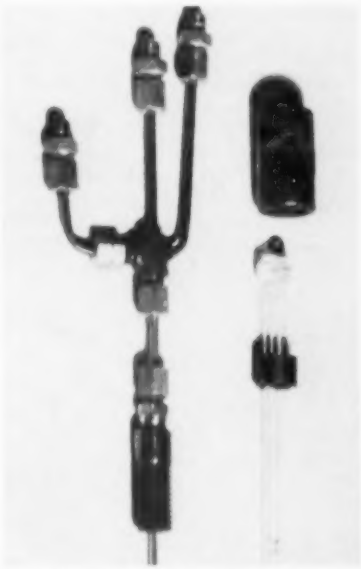


FIG. 2—This 5 cc equilibrium cell can be used up to pressures of 1500 psi. Other cells used vary in volume from 1.3 to 12.5 cc

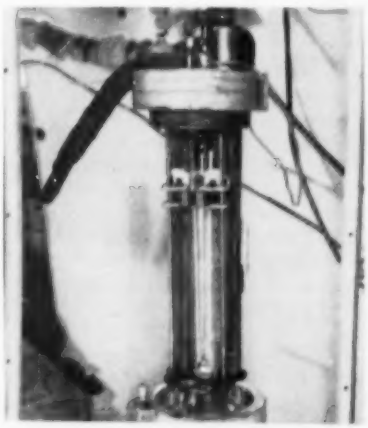
P-V-T Measurements

Above room temperatures the volumetric behavior of the gas is easily measured by metering increments of gas from the pump into the evacuated low pressure reservoir. Precise knowledge of the reservoir volume, temperature and pressure provides accurate volumetric data.

The glass equilibrium cell and the low temperature bath are used for

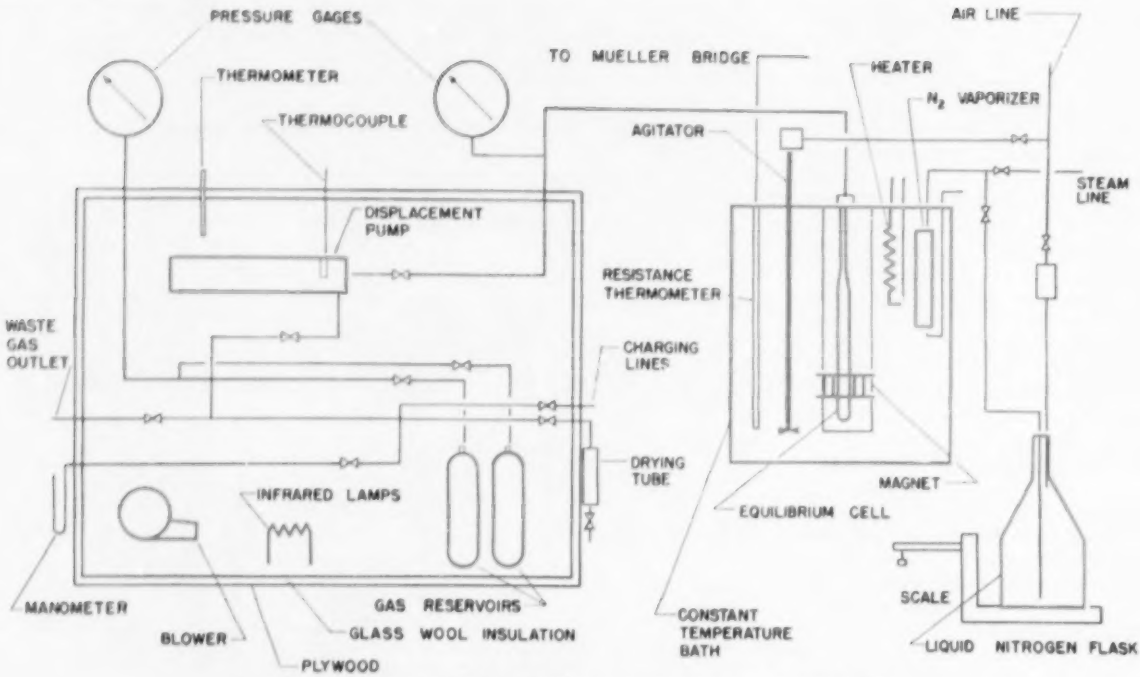


SAMPLING CELL of Pyrex glass confines the fluid being tested and permits visual observation of the fluids



CONSTANT TEMPERATURE BATH is contained in a dewar flask and maintains equilibrium cell at ±0.05°F with heating coil or nitrogen

■ *Phase Study Apparatus*



FLOW DIAGRAM SHOWS SIMPLICITY of apparatus for studying fluids under high pressures and low temperatures

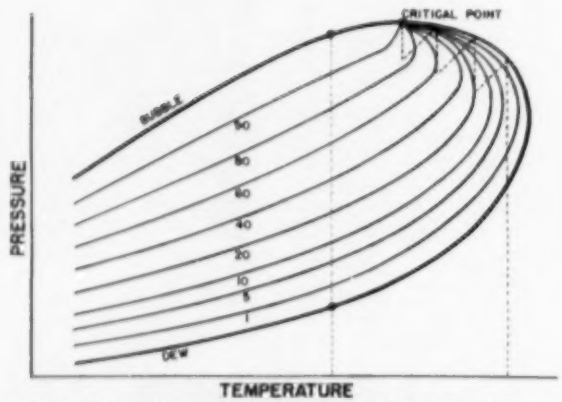


FIG. 3—The critical point of liquid and vapor mixtures is another accomplishment of the equilibrium-cell apparatus

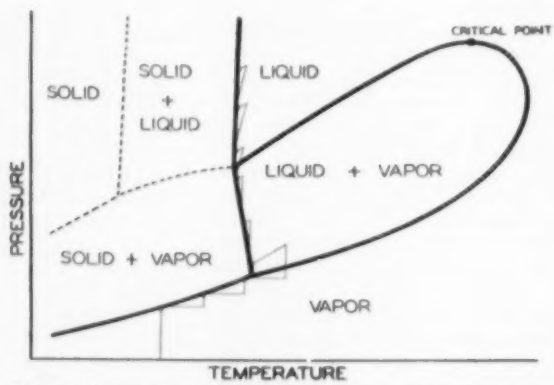


FIG. 4—A complete phase diagram for a general gas mixture can be determined by test procedures, as described in this article

volumetric measurements below room temperatures. Here, the largest cell consistent with the pressure requirement is used. For example, the 12.5 cc cell cannot be expected to perform continuously at pressures above 1200 psi. The volumetric data are taken by injecting known increments of gas from the pump into the cell at constant temperature and observing the pressure rise.

At temperatures below the condensation temperatures of the gas, liquid density is determined by metering sufficient gas into the cell so that it is filled with liquid.

Vapor-Liquid Equilibria

For binary systems, the vapor liquid equilibria is readily obtained from bubble point and dew point determinations of several mixtures at various temperatures.

Direct measurement of vapor-liquid equilibria can not be made on mulicomponent mixtures. Nevertheless the determination of bubble and dew point curves of these mixtures are of positive value in checking the accuracy of various equilibrium constant correlations.

In the course of phase boundary determinations, the accurate knowledge of the critical point of the mixtures is always desired. For rapid determination of the critical point, the following procedure is used: Starting at some temperature above the critical but below the cricondentherm, the gas is made to pass through the lower and upper dew point. The bath temperature is then reduced, causing the formation of two phases in the cell. Then, maintaining this lower temperature, more gas is injected into the cell and the liquid level is noted after each injection. After the upper dew point is

Previous Work in This Field

Apparatus for the measurement of the properties of fluids under extreme conditions has often evolved as equipment specifically designed to measure the vapor-liquid equilibrium relationships of various systems.[1,3,6] Sage Lacey[6] used a high pressure all metal bomb during investigations of vapor-liquid equilibria of hydrocarbon systems. Bloomer and Parent[1] used a dewbubble point apparatus during their investigation of the volumetric and phase behavior of the nitrogen-methane system at low temperatures. Their apparatus featured an inverted glass cell in which the phase changes could be visually observed. Davis, Gore, and Kurata[3] used very similar equipment in their observations on natural gases at low temperatures. The present apparatus is a modification of the same type featuring increased versatility.

reached the bath temperature is again lowered, and the procedure is repeated. The path of the process is shown in Fig. 3. A temperature is finally reached at which the cell is filled with liquid. The critical temperature will lie at the point where the bubble and dew points coincide.

Solid-Vapor, Solid-Liquid, and Solid-Liquid-Vapor Equilibria

Figure 4 is a schematic sketch of the complete phase diagram for a general gas mixture. A large part of the solid equilibria profile may be determined by a method similar to the one used by Donnely and Katz on methanecarbon dioxide system[4]. Starting at some low temperature, gas is injected into the equilibrium cell, slowly building up the pressure to the snow point. (This is the pressure at which the first crystals of solid form from the vapor at the existing bath temperature.) The bath temperature is now raised a few degrees and a new snow point obtained by injection of more gas into the cell.

This procedure is repeated until the formation of dew in the cell shows that the vapor-liquid region has been reached. At this temperature sufficient gas is added to the cell to form a measurable liquid layer. The cell is then slowly cooled until solid crystals are formed and there are three phases coexisting in equilibrium.

The three phase line may be defined by alternately raising the cell pressure by gas injection and lowering the temperature, obtaining several additional points at which the three phases are in equilibrium. By this method a pressure is reached at which the cell is full of liquid. At this bubble point pressure there is a temperature at which a minute amount of solid can exist in equilibrium with the liquid. This point is usually referred to as the crystal point.

The locus of crystal points is obtained in the same manner as the solid-liquid-vapor line. Because this line is almost straight, only a few points are needed to define it. The dotted phase lines on Figure 4 are solid phase boundary lines.

Unfortunately, it is not possible to use the cell to define exactly the point at which the gas is all solid. It may be approximated by cooling the mixture well into the solid region and extrapolating the solidity percentage in the cell to 100% solid.

Partial Miscibility in Binary Systems

Some nonideal systems exist under certain conditions of temperature and pressure in more than one liquid phase. It has been empirically observed that the number of liquid phases never exceeds the number of components[5]. For binary systems under conditions where a vapor phase coexists with two liquid phases, the system is isothermally invarient and the pressure and composition of each phase is fixed. Addition or withdrawal of part of each or of all the phases does not change the composition or pressure of the system provided the temperature is held constant.

The regular equilibrium cells, in the three phase region, can only be used in defining the limits of liquid miscibility. By varying the temperature over the three phase region the upper critical solution temperature can be defined. It may be possible to define the lower critical solution temperature if the appearance of a solid phase does not interfere.

The sampling cell adapter with hypodermic needle sampling tubes was designed to provide a means of sampling the phases. The longest sample tube extends close to the bottom of the cell while the other one is at a higher level. The two sample tubes are silver soldered into the outlet of a ⅛-in. stainless tee. The sampling cell has a neck of 3 mm inside diameter to permit the pasasge of the two hypodermic tubes. The two liquid phases in equilibrium are sampled by these sample tubes.

After the upper liquid layer has been sampled through the upper sample tube, enough liquid can be withdrawn through the lower sample tube to lower the liquid level of the upper layer below the upper sample tube. This allows a sample of the vapor phase to be withdrawn through the upper sample tube. Because the vapor space is small, vaporization from the

Meet the Authors

Dr. Kurata

Dr. Kohn

Fred Kurata, Professor of Chemical Engineering at University of Kansas, graduated from California Institute of Technology and did graduate work at University of Michigan. After several years of industrial experience, he has concentrated on the study of high pressure phase and volumetric behavior and reaction kinetics at the University of Kansas, and has written several papers on these topics. He is also known as a consulting chemical engineer.

James P. Kohn, now an assistant professor of Chemical Engineering at the University of Notre Dame, worked with Fred Kurata at the University of Kansas while studying for his M.S. and Ph.D. degrees. Before accepting his teaching post he was employed by Reilly Tar and Chemical Corp.

liquid layers is necessary in order to obtain a large enough sample for analysis.

Viscosity-Temperature

The viscosity of fluid systems at low temperature and high pressures can be readily determined using the glass equilibrium cell. Here the cell is used as a falling ball viscometer. The cell is first calibrated at various temperature with a reference liquid. The calibration temperature may be any convenient temperature at which the density of the reference liquid is known. The cell is then used with fluids of unknown viscosity. Here the cell is usually filled with liquid and is at its bubble point. The bubble point density is easily obtained by the method previously described, and the viscosity of the fluid can be calculated from the time for the ball to fall.

Solid Solubility

In binary systems the solubility of the solid component in the liquid phase can be determined under any conditions of temperature and pressure under which a vapor phase is present. Under these conditions the system is isothermally invarient. The liquid and vapor may be sampled through the hypodermic sample tubes in the same manner as described for sampling two liquid layers. Solid solubility data are useful in completing the temperature-composition crossplots of pressure-temperature diagrams. At low pressures the isobars may be difficult to define in any other way.

Acknowledgment

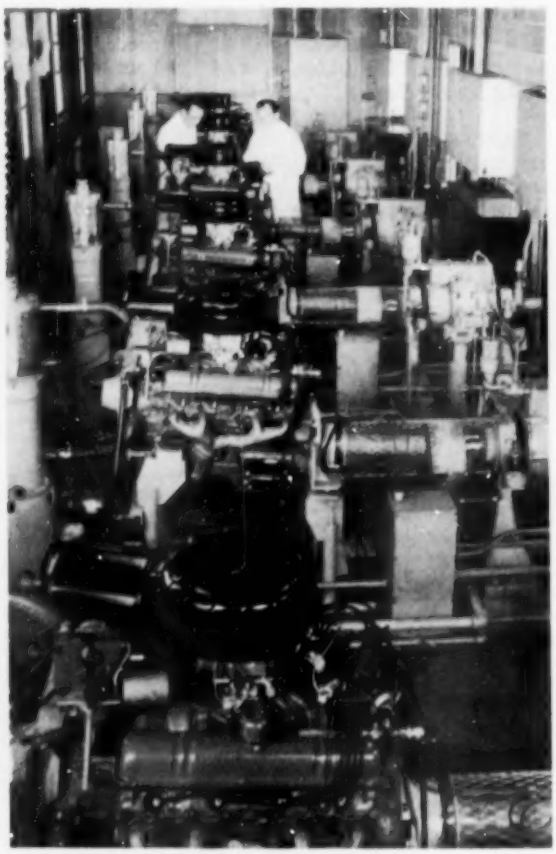
Financial assistance during the development of the apparatus and method described has been received from the University of Kansas Fund for Research, Project 17 and the Dow Chemical Co. All pure grade hydrocarbon liquids and gases used in this work were generously supplied by Phillips Petroleum Company. Mr. Morris Teplitz of the University of Kansas Research Foundation has generously loaned equipment and furnished many helpful suggestions.

Bibliography

(1) Bloomer, O. T., and Parent, J. D., *Chemical Engineering Progress* Symposium Series **49**, No. 6, II, (1953).
(2) Davis, P. C., Gore, T. L., and Kurata, F., *Ind. Eng. Chem.*, **43**, 1826, (1951).
(3) Davis, P. C., Gore, T. L., and Kurata, F., *Petroleum Transactions, A.I.M.E.*, **195**, (1952).
(4) Donnelly, H. G., and Katz, D. L., *Ind. Eng. Chem.*, **46**, 511, (1954).
(5) Findlay, A., "The Phase Rule," 9th ed., p. 8, New York Dover Publications, 1951.
(6) Sage, B. H., and Lacey, W. N., *Ind. Eng. Chem.*, **26**, 103, (1934).

NEWS in VIEWS

NOT POPCORN—BUTYL RUBBER particles moving along a conveyor belt under watchful eye of inspector at the new one ton/day pilot plant operated by Esso Research Laboratories at Baton Rouge, La.



A SHOW FOR THE ROAD is put on by these test engines at Shell Oil's Wood River, Ill., research center. Electronically controlled, the units give "road test results" faster than conventional fleets.

7 Ideas You Can Use in...

Designing for High Pressure

IF, AND WHEN, you are confronted with designing, engineering, or building a modern high pressure process plant—like an ammonia plant in the 5,000 to 15,000 psi range, for instance—here are seven helpful points to keep in mind:

1. Make the schedule flexible enough to accommodate equipment fabrication difficulties.
2. Give extreme protection to high pressure valves during construction.
3. Use a modified double-cone-type gasket for bolted closures.
4. Use high pressure flange-connection bolts in multiples of four, regardless of gasket design.
5. Check all low-temperature equipment for proper selection of alloys for sub-zero work, and keep flanged joints to a minimum.
6. Use air expanders that dissipate energy through an electric or air brake; don't use them to drive other equipment.
7. Avoid openings cut or stubbed into the sides of high-pressure tubing so that allowable design stresses can be increased.

These are the admonitions of C. E. Freese of The Fluor Corp. Ltd. as presented to the ASME Petroleum Conference in Dallas, Texas, held in September. They are based on his own recent experience in the design of an ammonia plant, although many of his cautions are pertinent to other high pressure plants than ammonia.

Today, plants using high pressures up to 15,000 psi are becoming familiar. In the past, this kind of construction was restricted to a few ammonia plants and the early polyethylene plants. But with the recent strides in processing techniques, many refining and petrochemical plants will soon find high pressure units within their battery limits. When they do, they will realize that the design and construction of high pressure plants will demand new solutions for many problems. Some of these were suggested in Freese's recent talk.

1 Make Your Schedule Flexible

Although the design criteria for high pressure vessels are fairly well developed, each manufacturer has his own methods of fabrication. Not only this individual fabrication approach but the variation in governing state laws prompts liberal scheduling in the delivery date for high pressure vessels.

An example of the varying legal requirements is one which stated that an ammonia separator should have walls 6⅝-in. thick for 10,000 psi operation. Yet, in another locality walls of 7⅞-in. thickness were legally required.

Fabrication delays may often prevent maintaining a construction schedule for a high pressure plant, regardless of whether a forged steel or welded multilayer vessel is purchased. Trouble is sometimes met in forged vessels during the heat treating, making it necessary to reheat-treat several times to attain desired physical properties. When it is realized that a forging weighing nearly 100,000 lb does not cool very fast, this can be a serious cutback in construction schedule. On one job this difficulty delayed construction nearly 2 months.

In multilayer vessels, similar trouble can occur but the delay is more apt to be caused by a defect in the forged steel head. Unfortunately this does not show up until after welding the head to the shell. Trouble of this nature delayed another job eight weeks because it was necessary to obtain repair approval from both the customer and the state authorities before completing the repair.

2 Protect High Pressure Valves

For ammonia plants, both balanced and semi-balanced designed valves are used for the high pressures. Most of them have a body of a large forged-steel block, machined to receive valve parts, and may be of American or European design. The packing in the stuffing boxes is normally Teflon-asbestos.

These valves should receive extreme protection from corrosion during the construction period and should be cleaned just before startup. The packing glands should be tightened gradually *only* during the start up; no attempt to seal them should be made at any other time.

The worst enemy of these special valves is dirt. Every effort should be made to keep the valve assemblies clean at all times. For, valves not properly protected during construction are in worse condition for startup than if they had been in use.

3 Use Double-Cone Gaskets for Closures

Because it is customary to use removeable heads for high pressure ammonia vessels, selection of the best type of gasket closure is important. The most accepted types are:

Needed Now—a New Pressure Code

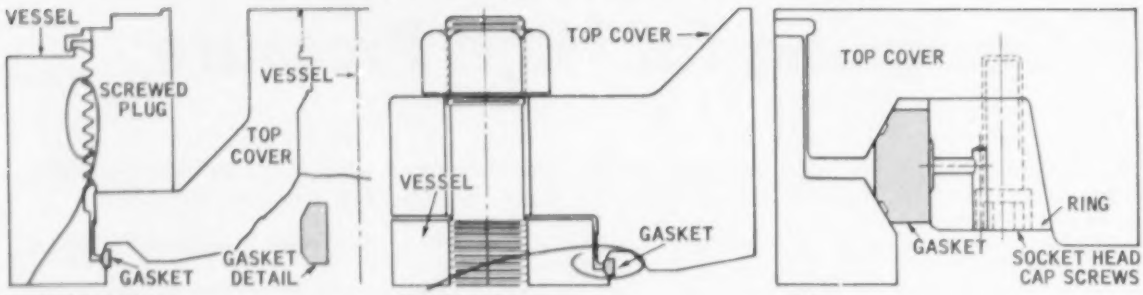
AT PRESENT fabrication of most pressure vessels is based on the design principles recognized by the ASME Boiler and Pressure Vessel Code. But the latest issue of Section VIII for Unfired Pressure Vessels, published in 1956, is applicable up to only 3,000 psi. What about vessels above 3,000 psi?

Many engineering firms, as well as their customers who are now branching into high pressure plants, would like to see a new code developed to cover these higher pressures. Such a code would do much to simplify the engineering and construction—and shorten the present delay in getting these plants onstream.

An extended ASME code, or a similar design standard, seems to be the answer. But even this is not easy to draft, for the "right" design is complicated by the wide choice of possible alloys for various high pressure processes.

But until some progress is made in standardizing the design of plants operating under high pressure conditions, it will be necessary for the purchaser, the engineering firm, the vessel fabricator—and possibly the insurance company—to evaluate the design for each separate plant as it is constructed.

Three Steps in High Pressure Closure Design



TROUBLE: Dirt in threads caused damage

TROUBLE: Pressure deflected gasket inward

O.K.

STEP 1 Double cone gasket has two sealing faces on outer rim. Flange is secured by screwed plug, making closure strong, but dirt in plug damaged threads. This led to...

STEP 2 Replacement of screwed plug with large diameter stud. But above-normal preloading of bolts caused too much inward deflection of gasket, leading to . . .

STEP 3 Retaining shoulder is provided to prevent inward deflection of gasket. Concentric groove and ports provide needed pressure against inside surface of gasket

a) Bridgeman closure — a well-known self sealing joint.

b) Delta-gasket closure—developed by DuPont Co, and

c) Double-cone closure—designed in Europe.

Freese recommends the last type, which consists of a sealing ring with two matched faces at 30-degrees from the vertical that form part of the outer surface (see Step 1). The pressure acting on the inner diameter of this gasket expands it into the gasket-sealing surfaces of the shell and the head. As deflection increases under pressure the gasket—made of aluminum for ammonia service—expands in place to maintain a seal.

In the original design of the double-cone gasket, the assembly was held in place by a large threaded plug. From a strength standpoint this arrangement is satisfactory. But it has been known to suffer thread damage from dirt and, in one installation, required returning the entire vessel to the factory for removal of the plug. Even though a three-piece plug may overcome this trouble, several recent jobs designed for over 10,000 psi used large diameter studs instead—as shown in Step 2.

For these jobs no change was made in the way the gasket head contacted the vessel shell. However, in order to overcome possible excessive inward deflection—by preloading bolts tighter than normal to overcome surface variations in gaskets or vessel—a slight modification was used. This modification, shown in Step 3, provided a shoulder 0.020 in. smaller than the gasket inner diameter. To retain the pressure seal, a groove was cut in the entire circumference of the shoulder, and holes were provided to ensure that the pressure acted on the inside diameter of the gasket.

This modified design gives a more solid indication of contacting when bolting. However, good workmanship in machining the gaskets is still important. Forged-aluminum gaskets with slight tearing marks will not seal even though softened by annealing. Units that don't use the described modification need a more perfect gasket surface plus uniform tightening of the bolts.

Complete protection of the double-cone gasket surfaces before final assembly is essential. On one project an attempt was made to protect these surfaces with a plastic, placing silica gel in the vessel. But the manufacturer had provided a temporary gasket between the bolts and the outside rim of the flange. Moist air leaked into the vessel around the bolts and the plastic coating did not prevent corrosion. It was necessary to reface the gasket seat by lapping, and clean the heads by machining.

Despite the above troubles that may be experienced during assembly, the double-cone gasket has these advantages:

a) It requires very little initial bolt loading

b) It can be used several times if properly handled

c It disassembles easily

d) It is not necessary to retighten if operating pressure drops below normal.

4 Use Proper Bolt Arrangement

For high pressure flange connections in ammonia plant construction, some manufacturers use 6-bolt flanges instead of bolts in multiples of four. This is not recommended by Freese because the proper orientation of bolt holes is a serious problem when six bolts are used with weld-neck flanges.

Two popular gasket designs are used in ammonia plant construction —the lens-ring and retained copper-gasket joint (Types 4 and 5). The **lens-ring gasket** is a solid steel disc with spherical machined surfaces. Initially, it makes a line contact with the flange face that is usually machined to a 20-deg bevel. This line contact becomes a band contact as the flange is bolted. The flange face is slightly indented. This gasket is a good design but it may be necessary to refinish the flange face after use as well as replace or remachine the gasket itself. Many believe this gasket is capable of taking considerable misalignment but Freese thinks trouble is apt to develop if the misalignment is more than 2 degrees. If misalignment is suspected, then spherical washers should be used under the bolts.

The other type of joint commonly used, the **retained copper-gasket** joint, is basically a double male and female joint using annealed copper for the gasket material. The gasket faces have one or two small V-grooves into which the soft copper flows to form a seal. It makes a good joint, and it is surprising how much abuse it will take and still seal satisfactorily under considerable pressure.

On one job described by Freese, trouble developed because the pipe fabricator did not plan and supervise the hydrostatic test properly. Blind flanges were tightened with a heavy-duty impact wrench, and all standard tightening procedures were ignored. After impact tightening the first bolt to the limit, the adjacent rather than the opposite bolt was next tightened. This fabricator was also using the gaskets over and over again: it was

hard to imagine their holding a 15,000 psi hydrostatic test.

5 Check Alloys For Low-temperature Use

For liquid air plants most of the mechanical equipment includes heat exchangers, packed columns, filters, and distillation columns. The bulk of it operates at sub-zero temperatures, which requires extensive use of austenitic steels. Because flanges present troubles at these low temperatures welded connections should be used whenever possible. Where flanges are used the most common gasket materials are either Teflon-asbestos or spirally wound metal gaskets with asbestos between the metal layers. The flanges used are usually lap joint with both the stub end and the flange itself made from an alloy that will operate satisfactorily at low temperatures.

Alloys for these low temperatures are specified in ASTM A-300 and A-320. It is wise to check the material furnished against these standards, especially if the air plant is not furnished by an American firm because these standards are not observed in all countries.

6 Don't Use Air Expanders As Drive Units

The primary purpose of an air expander in a liquid air plant is to dissipate energy, and this should be done through an electrical brake or an air brake. On one recent job, trying to use the expander as a drive unit caused considerable delay in the entire project because it was also the drive unit for a centrifugal compressor handling nitrogen. This particular expander is different from most in that it is two turbines in one: it has two turbine wheels of the same size on the same shaft and operates at a speed above 10,000 rpm and a temperature of nearly -300°F. Although it was an excellent idea, this equipment arrangement prevented other sections of the plant from operating while design problems of the unusual expander were corrected. It would have been better to use a conventional air or electrical brake.

7 Don't Cut Openings Into High Pressure Tubing

Most piping for ammonia synthesis can be carbon steel because anhydrous ammonia does not corrode it. But alloys are used where extreme strength is required, with chrome-moly used at the outlet side of the converters where the temperature is about 500°F.

The final selection of carbon-steel tubing for several recent plants consisted of modifying the analysis of ASTM A 106 B pipe material, permitting a yield point of 40,000 psi and an ultimate tensile strength of 70,000 psi. A similar modification was later approved by the ASME Boiler Code Committee under Case No. 1207, although it permitted higher carbon than the modification made for ammonia plants.

Because the carbon-steel tubing operates at only 375°F in this application, the allowable stress was taken as 22,000 psi with 0.05 in. allowed for corrosion. If no corrosion is considered, (as is the case on the inside surface) then 20,000 psi stress is allowed. For 2¼ chrome-½ molybdenum tubing that was likewise ordered to a 40,000 psi minimum yield point, this same allowable stress was used.

This is permissible if no openings are cut or stubbed into the sides of the tubes. And it is believed that these allowable stresses can be even further increased when it is realized that: (a) the maximum hoop stress is only on the inside surface of the tube and diminishes rapidly to the outside surface; and (b) American allowable stresses are very conservative compared to the French, who permit maximum stress to get fairly close to the yield point.

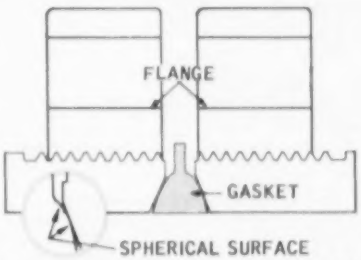
If American tubing is compared to French tubing, it will be found that the French use thinner wall thicknesses for the same pressure. Also the French stress their material higher but are more strict on manufacturing tolerances. In Europe this is followed partly because the material involved is more important than the labor. It is not difficult to obtain a mill tolerance in Europe of ±5% wall thickness, instead of the ±10% for cold-drawn seamless tubing in this country.

Flange design is important too, regardless of the type of gasket and number of bolts used, as a suitable flange and bolting must be provided for the high pressures involved in ammonia plant design. Here again, American practices differ from the European. Several recent plants have used gasket loading constants and allowable stresses as published by the ASME Boiler Code, with flanges screwed on the stub ends instead of using a shouldered lap joint construction.

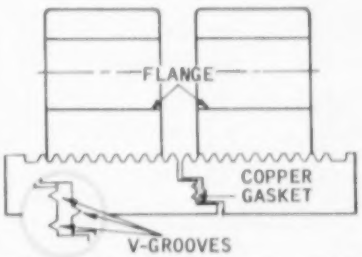
Investigation of estimated stresses in a shouldered stub end design revealed an over-stressed condition, even though the shoulder was much thicker and heavier than the usual lap-joint stub end. Part of the technique correcting this is shown in Type 6, where a tapered shoulder places the reaction forces closer to the gasket center.

The threaded flange, however has certain definite advantages. It can be adjusted to obtain a variable space between flanges or to clear other parts, and it is removable by unscrewing without cutting or welding. It has the disadvantage, though, of seizing on the thread if the stub-end thread has been damaged or dirt is lodged in the threads.

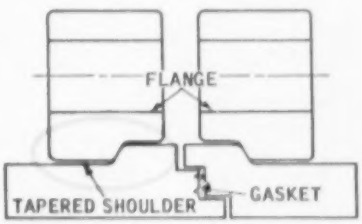
Three Popular Gasket Types Used in Ammonia Plant Construction



TYPE 1 Lens ring gasket with spherical surface on outer edge of steel disc makes initial line contact



TYPE 2 Retained copper gasket seals high pressures by flowing soft copper in V-grooves during tightening



TYPE 3 Tapered shoulder on retained copper gasket closure places reaction forces close to gasket center

Clean Towers Chemically?

special steel to prevent damage from continued exposure to the cleaning solution. This is usually solved by having a special pump for chemical cleaning only. This pump can be mounted on a portable base, either with or without the chemical cleaning solution storage tank.

In some instances, the bottom of the tower being cleaned is a suitable reservoir for the cleaning solution.

The cleaning solution must be held at some predetermined temperature level to assure optimum cleaning. The reboilers or heat exchangers on the unit can often be used to heat the cleaning solution, though more versatility is allowed by having steam heating coils within the cleaning solution storage tank, as shown in the two drawings of chemical cleaning hookups.

Agitation within the tower being cleaned may be adequate without external means. However, additional agitation can be had by injecting steam, gas or air at the tower bottom.

Circulation continues for the cleaning material until no more deposit is removed—as determined by periodic sampling and analysis of the cleaning solution.

Flushing of the tower, or use of a neutralizing agent, is usually needed after the cleaning cycle is over. The flush cycle is usually circulated in the same way that the cleaning solution was.

When completed with cleaning and flushing, it is not uncommon to find some unreacted materials lying loose on the tower internals. These are easily removed by hand.

Cleaning Case Histories

One example of savings possible by chemical cleaning is shown by a depropanizer tower and an absorber in a gas plant. Standard practice was to shut the units down and hand-clean them every nine months. Labor costs were $4,600.

An acid cleaning procedure was developed that required only $200 for labor and $1,300 for materials. Other advantages of the acid cleaning were that (once the method was proven) it was not necessary to open the towers after each chemical cleaning, and, therefore, it was possible to extend the maintenance shutdown intervals from nine months to a new cycle of every two years.

Even when the cleaning intervals were reduced to every six months, there was an annual saving of $1,733 in maintenance costs over the nine-month mechanical cleaning cycle, and an annual saving of 3 2/7 days of downtime. Also, the operation of the tower improved with chemical cleaning.

A second example of savings from chemical cleaning is for a vacuum tower designed to make penetration asphalt from heavy crude (see Fig. 2).

The cleaning trailer shown in Fig. 2 has a capacity of 1800 gal of cleaning solution. The tank is divided into six compartments, each holding three-hundred gal. The compartments are fitted with steam coils and over-and-under baffles to aid in settling out heavy particles as well as to skim off light frothy materials.

An electrically driven centrifugal pump, capacity 800 gpm, is mounted on the trailer. The pump's return line is manifolded to give the use of either one, three, or all six of the compartments—depending upon the volume of circulation desired.

For a cleaning solution, a mixture of Oakite No. 8 and No. 88 was used. The solution temperature was held below 160°F for the first 2½ hours to give the No. 8 material time to completely degrease the tower before being boiled off.

Temperature was then increased to 250°F and circulated another eight hours to allow the No. 88 material to cut and wash out the coke particles.

Titrations were run at regular intervals and the solution strength brought back to optimum by adding fresh chemicals.

After a preliminary inspection, the vacuum tower was washed down with water to remove the chemicals. Next, a more thorough inspection was made, showing the tower to be cleaner than after mechanical cleaning.

Costs of cleaning the vacuum tower were only ⅓ those of mechanical cleaning, and the time only ¼ that needed for mechanical cleaning.

In using this procedure, it was found that the best and most economical results were possible when cleaning the tower immediately after shutdown—before it had cooled.

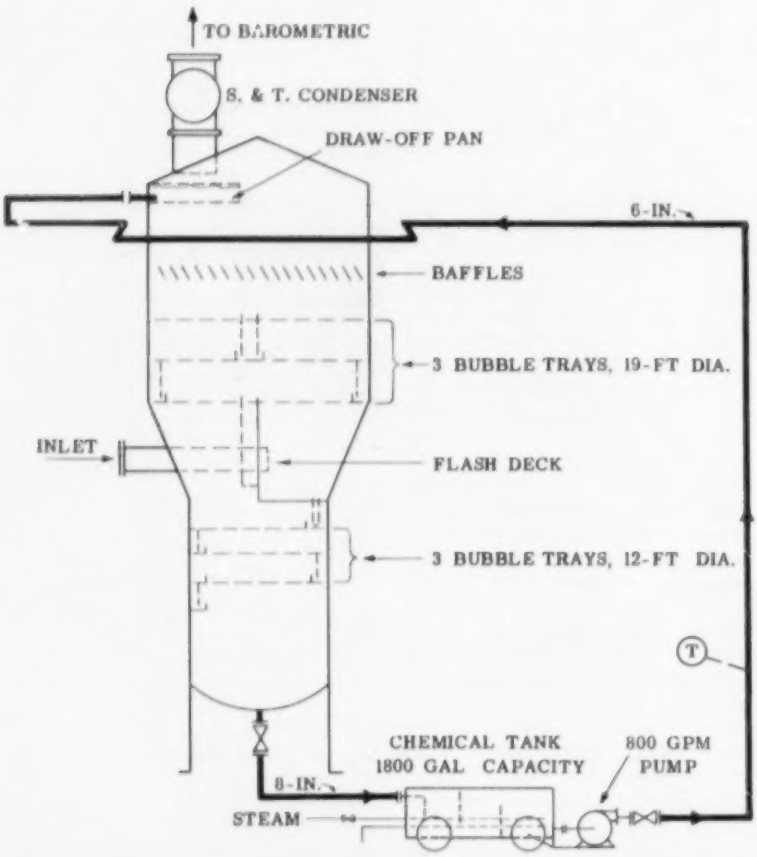
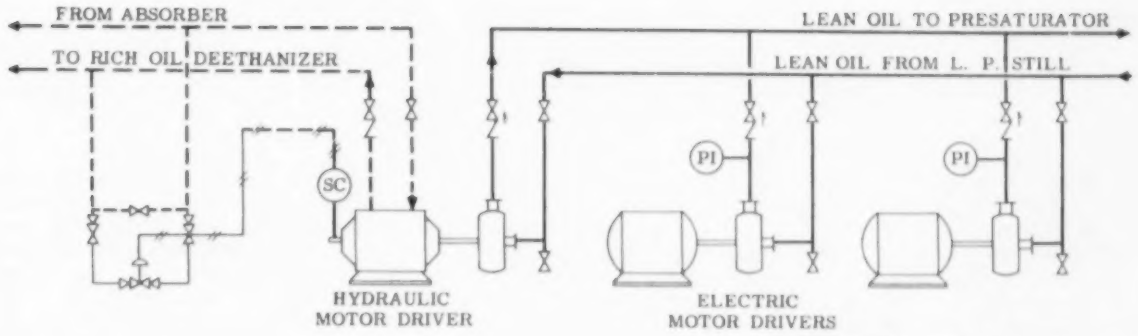
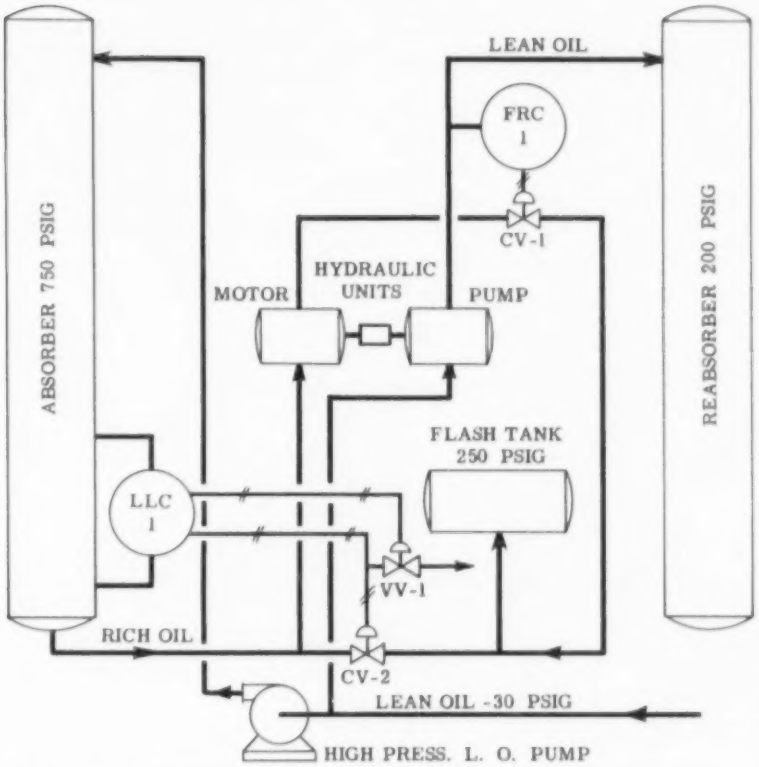


Fig. 2—**HOOK UP FOR CHEMICAL CLEANING** of vacuum reducing tower



CENTRIFUGAL TYPE hydraulic drive unit (above), shows control system



POSITIVE-DISPLACEMENT TYPE hydraulic driver, showing control arrangement with safety feature. Both systems are practical if you want to . . .

Run a Pump Backwards?

Why not? One of the schemes above can give you a useful driver

OF COURSE it's not a new idea. Applications of hydraulic energy to the performance of useful work date back to the Egyptians and the Romans.

But here's a relatively new application being made today in some gas processing plants with good results—a rich-oil power unit. It's a practical way to recover, for useful consumption, horsepower normally wasted in pressure reducing systems, according to B. J. Thompson of Warren Petroleum Co.* It works this way, as illustrated in the diagrams:

Either a turbine or a positive displacement type hydraulic unit is used to drive a lean oil pump. Energy comes from rich oil pressure letdown. Many natural gas processing plants utilize absorption oil at an elevated pressure to extract light hydrocarbons from the gas. Absorber operating pressures ranging from 500 to 2000 psi are common and a substantial number operate in the 700-800 psi range.

Common practice is to reduce the pressure of the rich-oil stream leaving the bottom of the absorber by 250-550 psi. If several hundred gallons of oil per minute are flowing through the system, a substantial hp loss is represented by this pressure letdown through a conventional diaphragm-operated control valve.

The two basic types of hydraulic drive units are: 1) the centrifugal or turbine design, and 2) the positive displacement design. Units in actual service range in horsepower from 15 to 225.

There are advantages and limitations to each type. The turbine design is less sensitive to non-lubricating properties of the power fluid and to foreign materials in the fluid system than is the positive displacement design. This is so because of the close tolerance and many moving parts in

a positive displacement unit. On the other hand, the latter will usually be lighter in weight and take less space than the centrifugal.

Most existing installations are in the trial or proving stage. One positive-type has been in service 4½ years. Some centrifugals (100 hp) have been operating about two years. One larger (225 hp) centrifugal has been running several months. All these units have given satisfactory performance.

Another example is a single-stage centrifugal taking inlet rich-oil at 435 psi and discharging it at 235 psi for an output of 175 hp. Still another unit, in three stages, takes inlet oil at 800 psi, delivers it at 250 psi for an output of 100 hp.

Delivered cost of various units used during the past five years has ranged from $20 to $210 per rated hp. The lower value represents positive displacement units in the 100 to 125-hp size. The higher figure has been the cost of some smaller (15 to 30 hp) centrifugals. In another comparison, a 40-hp displacement unit delivered for $67/hp, and a 100-hp centrifugal for $57/hp.

This wide cost range indicates that each installation is a special case, and should be carefully analyzed economically and mechanically before a final design is established.

Very little precise information on direct operating savings is as yet available. As service life is extended during future years, more helpful records of this figure will become available.

Control is relatively simple on hydraulic power units. The drawing of the centrifugal unit shows an installation which has been in operation for two years. It uses a flow controller for output demand by the driven unit in combination with speed control mounted directly on the shaft of the hydraulic turbine.

The speed control is a generator-type tachometer that transmits the speed of the hydraulic unit to a flow controller. If too much speed is developed, the flow controller—through an electro-pneumatic controller—reduces the speed by reducing the flow of rich oil.

Similar arrangements have been utilized to control the speed of positive displacement type power units. The electro-pneumatic control unit is believed unnecessary because a conventional pneumatic flow controller will transmit changes in diaphragm pressure to a master control valve.

Most hydraulic power units can be regulated over a wide range of speed and horsepower output.

Another control system—one for a positive displacement unit—is shown in the second drawing. A flow-recording controller operates a pneumatic control valve downstream of the hydraulic motor. There is a safety feature incorporated in this particular arrangement, involving two diaphragm-operated control valves in main-line flows and one vent valve. The portion of the system including the liquid level control (designated as LLC-1 in the drawing) and the diaphragm-operated control valve, CV-2, is conventional and will be found in most absorption systems. Vent valve VV-1 represents the added safety feature.

Operation. Flow controller FRC-1 actuates control valve CV-1 in accordance with the power demand to pump lean oil through the reabsorber tower. Any rich oil in excess of the quantity required for power will be by-passed automatically to the rich-oil vent tanks through control valve CV-2, which is actuated by increasing the level in the absorber at LLC-1.

However, if the oil supply to the absorber is interrupted, or if there is a high demand at CV-1 for rich oil, there will be a rapid drop in the liquid level in the absorber. The liquid seal at the bottom of the tower could be lost. Loss of seal could result in high-pressure gases flowing downstream into low-pressure distillation equipment.

To eliminate this hazard, the pilot on LLC-1 is adjusted so that when the output air pressure falls below 5 psig the vent valve VV-1 opens immediately. This action removes pressure from the diaphragm on CV-1, which then closes and prevents further flow through the system.

How efficient are the two types of hydraulic power units? There is a greater variation in efficiency as the speed changes in centrifugal units than in positive units. The latter type shows a smooth output-torque curve and, therefore, high efficiency over a wide range of speed and load. Actual efficiencies for various units have been reported from a low of zero to a high of about 80%.

Extremely low efficiencies occur for low-flow, low-speed conditions with centrifugal units. The optimum efficiency is attained from a centrifugal unit when it operates near its design speed and flow rate. It is thus apparent that such a unit is not the optimum choice when the installation will require wide variations in speed and horsepower. Centrifugal units do not lend themselves efficiently to services involving variable speeds because of their inherent characteristics, one of which is that their hydraulic horsepower varies as the cube of the speed value. Some designers feel that fluid flows under 200 gpm are uneconomical for a turbine unit.

On the other hand, a positive displacement unit produces a horsepower-capability curve almost directly proportional to the speed change. This results in flexibility for such applications as fan drives where it is desirable to change the speed to compensate for ambient-air temperature changes.

Operating tips include the following: Any system using hydraulic drivers should be thoroughly cleaned of all extraneous materials. A strainer should be installed—either temporarily or permanently—in the inlet piping to prevent entry of such foreign materials as dirt, welding slag, pipe scale, and other hard materials. This is, of course, especially important for the close-tolerance type units such as the positive-displacement design.

Vibration is a problem in some positive displacement units under certain operating conditions, particularly if the rich oil is flashing off some of the absorbed gases. A turbine unit will not vibrate because of any vapors present. It may even deliver a slightly larger power output when flash gases are present.

Several operators have been concerned with the proper point for throttling of a rich-oil stream through a power unit. One suggestion has been to avoid upstream throttling on a positive displacement unit. The theory is that this might result in enough flash vapors to effect a non-lubricating condition serious enough to cause extremely rapid wear of bearings and other precision parts.

Although this appeared to be true of some of the earlier installations, minor design alterations have apparently corrected the condition so that today the throttling valve can be either upstream or downstream. Periods of as much as 16 months of continuous operation have been recorded with no evidence of excessive wear.

Some operating records indicate that the presence of flash gases resulting from upstream throttling have provided as much as 8% additional horsepower recovered.

*The above article is based on a recent paper, "Hydraulic Drives Using Rich-Oil Power Units." Mr. Thompson is superintendent, technical service, Warren Petroleum Corp., Tulsa, Okla. He presented the paper at the Sept., 1956, Petroleum Mechanical Engineering Conference of the American Society of Mechanical Engineers in Dallas, Texas.

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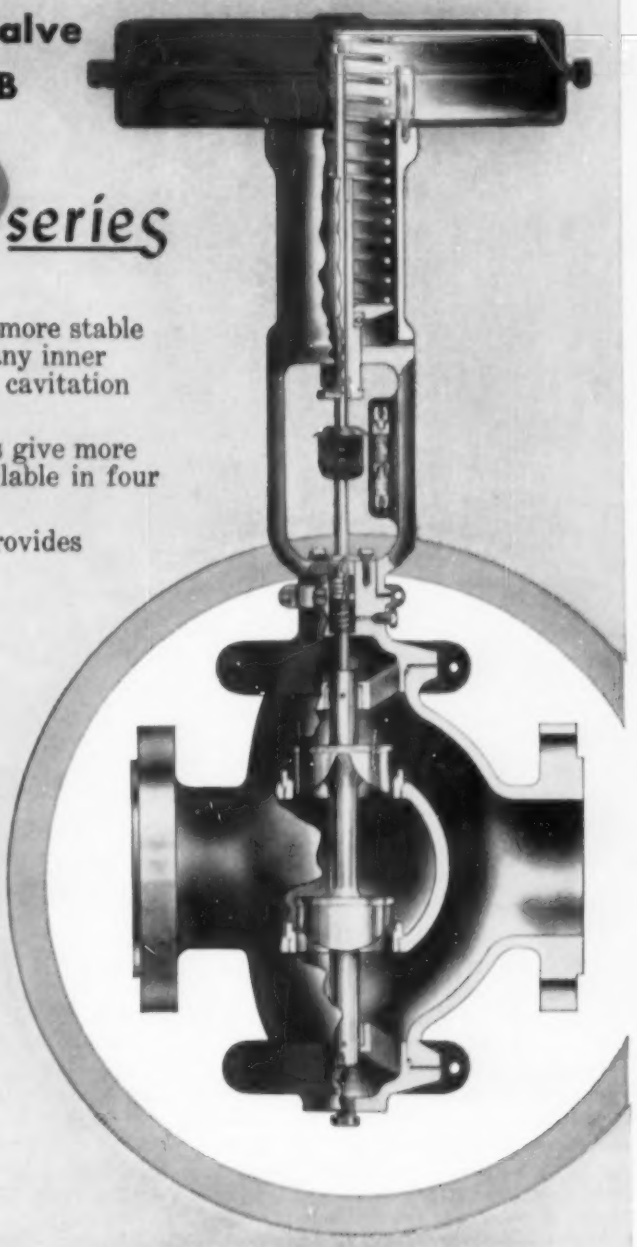

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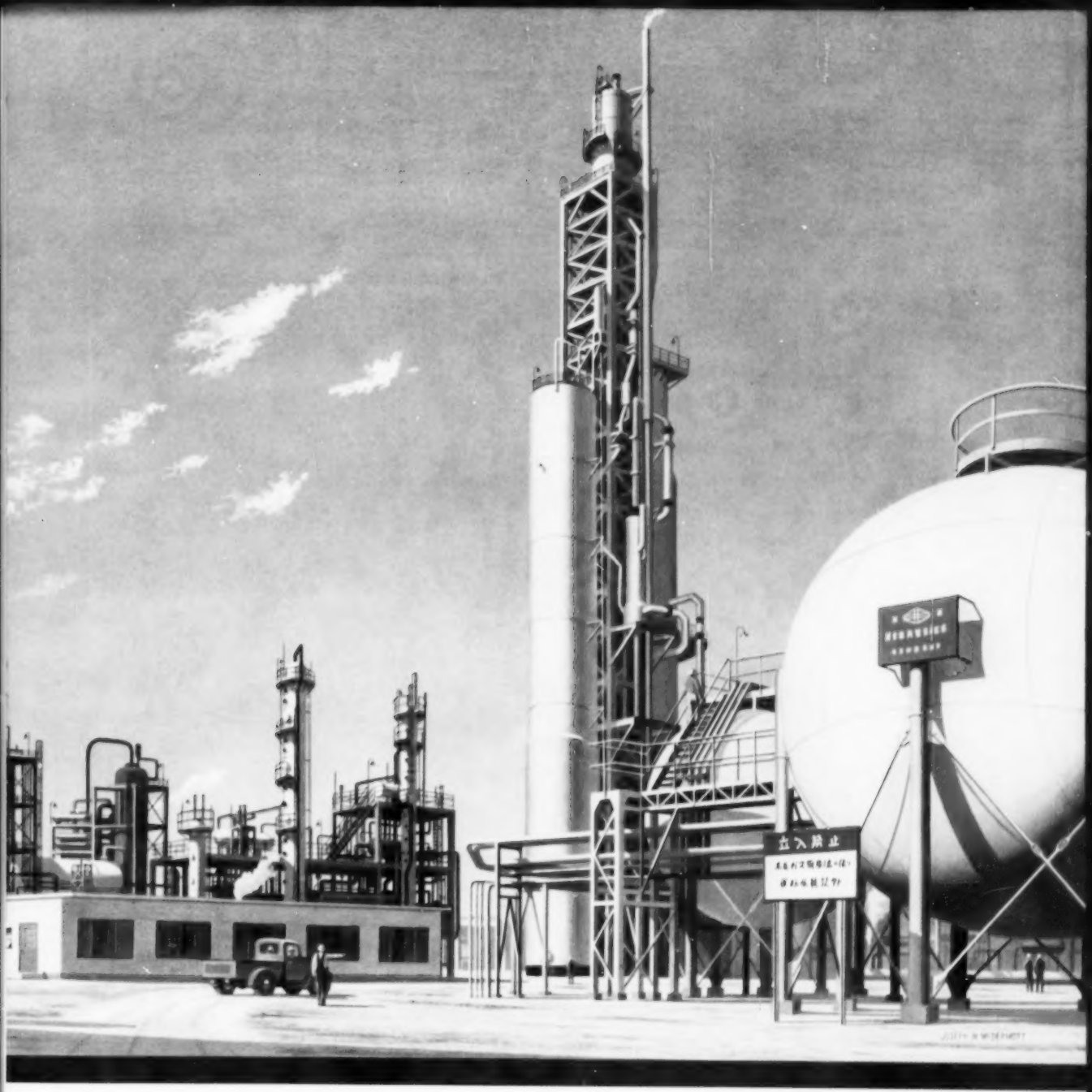

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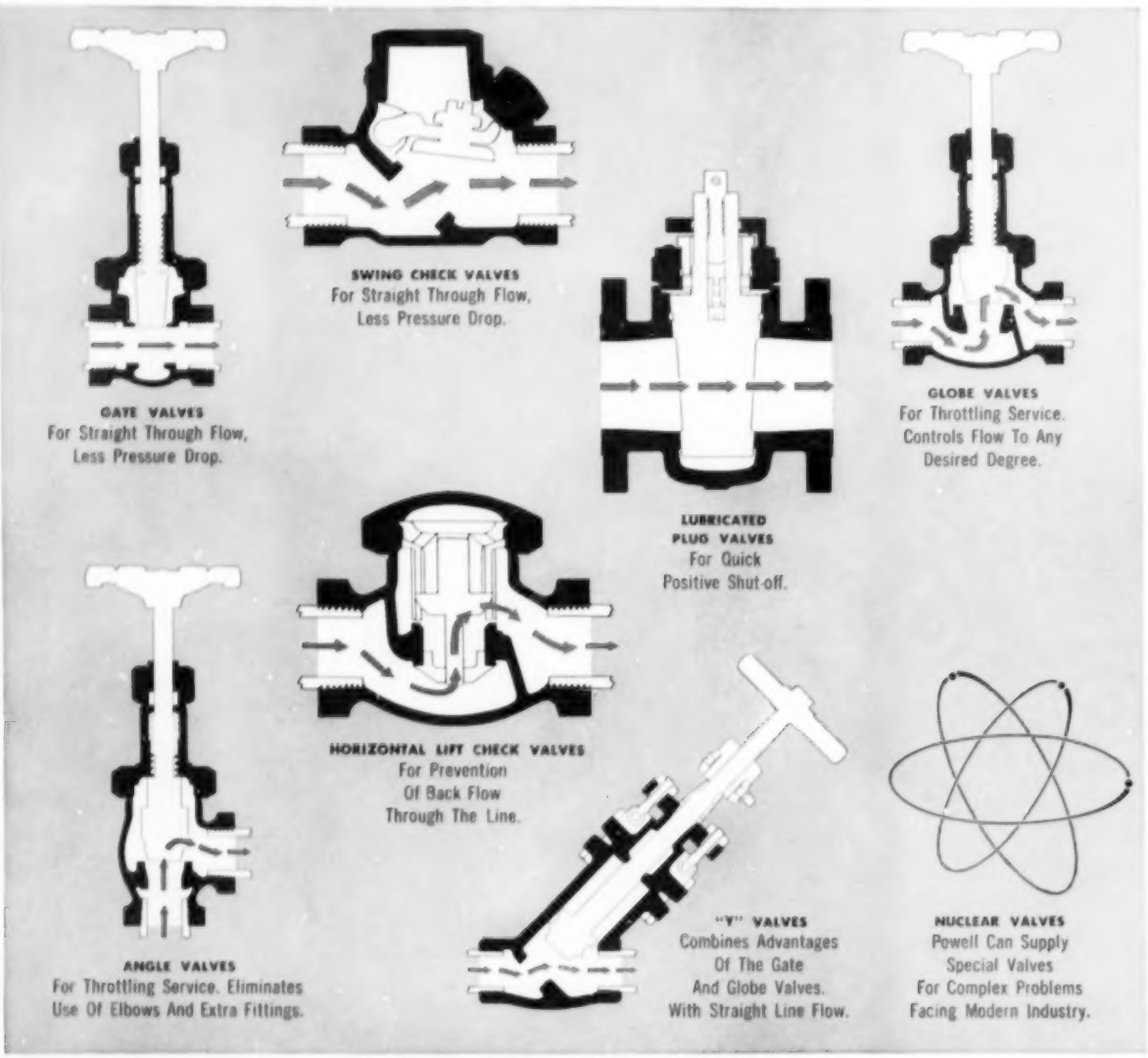

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Newest process information and flow diagram of Socony Mobil's moving-bed technique. p. 75

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Glossary of Metals

A helpful listing which may dispel some of the confusion in your mind as to what the trade-named alloys really are. p. 87

"I've Got a Problem . . ."

Maybe the solution is included in this month's Plant Practices. If your current problem is how to cool *and* heat cooling water—or finding a low-cost method for burning acid sludge—or accurate measurement of coke level, turn to p. 79

The Old Man Saves Christmas

The Bull Pen crowd had been having a bad time of it on a caustic wash tower. It looked for a while like it would ruin their Christmas Eve—but as usual, the Old Man had an idea that saved the day. Turn to . . . p. 83

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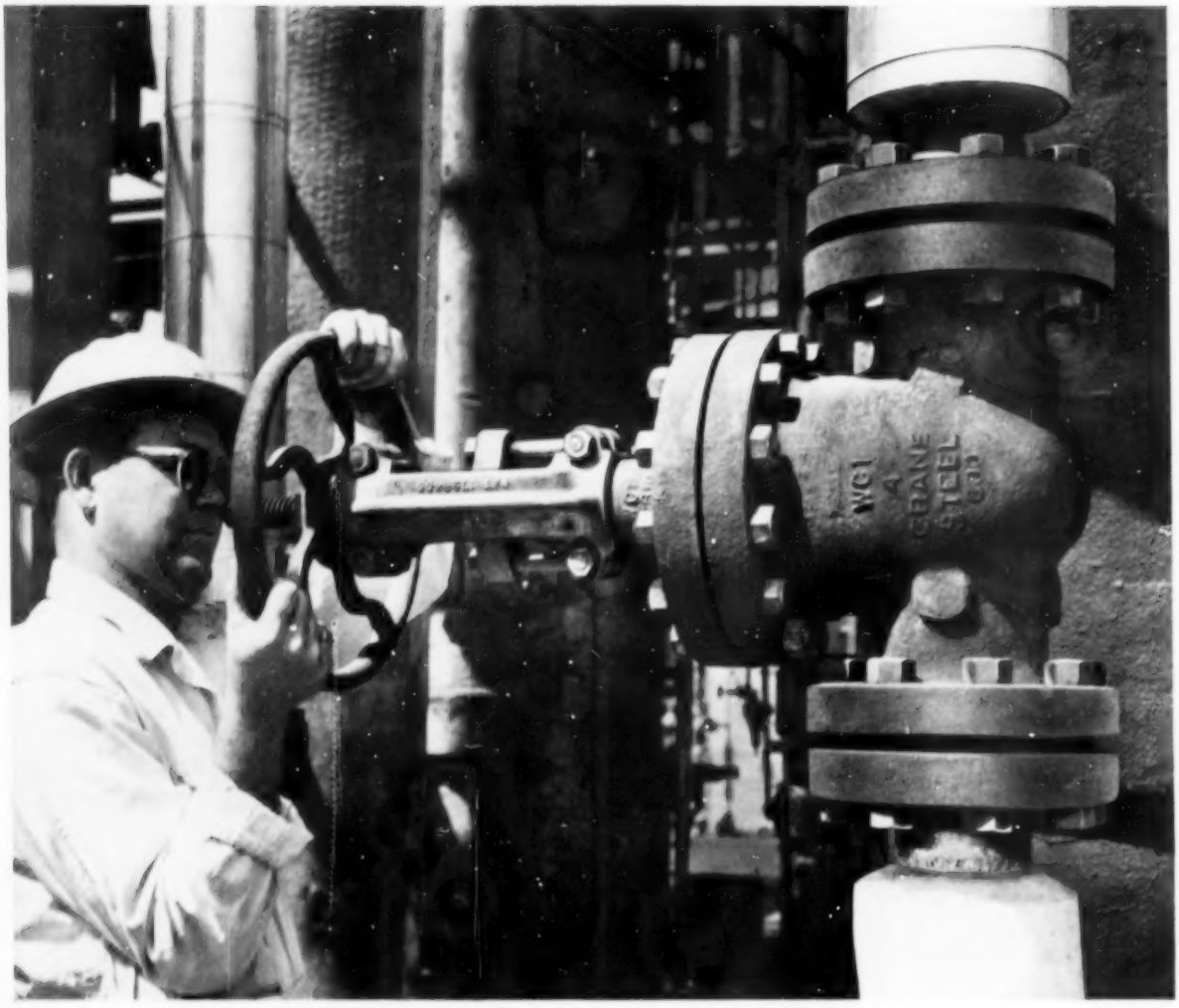
INDEX TO DEPARTMENTS

Advertisers' Index....114
Bull Pen....83
Editorials....148
Engineering "Clip-n-File" Data....87
Equipment—What's New!....117
Information Offered....112
Meetings for Oil Men....105
New Words in Your Reading....85
Operating Trends....109
Patents....99
Personals....91
Plant Practices....79
Process "Clip-n-File" Data....75
Readers' Service Card....115
Statistics—Operating Trends....109
Suppliers' News....95
What's New!....117



Two years on high-pressure hydrogen . . . no leakage . . . no maintenance!

Two years ago, Celanese Corp. installed this Crane valve in their large petrochemical plant in Bishop, Texas. It's a 4-inch No. 76XR 600-pound steel gate valve, on a line to a hydrogenation reactor. Pressure is 800 psi. and temperature 375° F.

What's the maintenance cost story on this valve—after 2 years of such severe service? *It hasn't cost a dime.* Celanese maintenance crews haven't been near it once with a wrench. Leakage? *Zero*—there hasn't been a trace of leakage during the 2 years the valve has been on the line.

Outstanding? Not for Crane valves. You'll find Crane valve performance records like this in chemical plants everywhere, and throughout industry. Crane's strictly quality design, materials, assembly and testing assure you of such dependable and low cost flow control service.

You'll find everything you need in valves and fittings in the complete Crane line. Get full information from your local Crane Representative, or write to the address below.

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START HERE

Process—Moving bed catalytic reforming process used to convert low octane naphthas to high octane gasoline blending stocks.

Process Flow—Referring to the flow diagram, the naphtha charge flows down through an absorber to attain the desired recovery of light hydrocarbons.

Enriched feed is then heat exchanged against reactor effluent, and charged into the reactor together with the heated recycle gas. The reactor contains a compact, downwardly moving bed of catalyst, into the center of which is fed the heated mixture of naphtha and recycle gas.

Effluent products from the top and bottom of the reactor are combined, cooled by heat exchange, and then flashed. The flashed gas is compressed and recontacted at higher pressure with the primary condensate, after which it is cooled and reflashed. This secondary off-gas forms the recycle stream, while the net make flows to the absorber for light hydrocarbon recovery.

Absorber off-gas is then sent to the refinery fuel system, or may be used in subsequent processes. The recycle gas may be dried and heat exchanged before being reheated and fed to the reactor.

Because a small amount of high boiling polymer is formed in the reaction, the reformate is rerun. It is expedient to separate the small yield of polymer in a two-tower rerun system, producing light and heavy reformates.

Catalyst—The catalyst is a chromia-alumina bead catalyst somewhat similar in appearance and physical properties to the TCC cracking bead catalyst, and is manufactured by Socony Mobil Oil Co. at Paulsboro, N. J. This catalyst is maintained at a high equilibrium activity in the unit by making up the normal attrition losses. This attrition loss is approximately 0.1 lb/bbl of naphtha charged to the reformer.

Regeneration—Since the process is of a continuous moving bed type, a kiln is provided for regeneration. This kiln is similar to the TCC cracking unit kiln, having alternate burning and cooling zones, and with the ability to completely reactivate the catalyst for reuse in the reactor section. The kiln operates at atmospheric conditions, and is controlled by maintaining regeneration temperatures with properly spaced water cooling coils.

Operating Conditions—Operating conditions for the TCR unit are as follows:

Catalyst circulation rate, t/hr	38
Straightrun naphtha feed, b/d	8000
Cracked naphtha feed, b/d	8000
Space velocity, v/hr/v	0.60
Catalyst/oil ratio, vol/vol	0.31
Hydrogen/naphtha ratio, mol/mol	3.2
Reactor inlet temperature, °F	965
Reactor pressure, psig	175
Maximum kiln temperature, °F	1050

Process Variables—Reactor pressure is usually maintained at about 175 psig, but may be varied between 100 and 200 psig for best results on different stocks. The gas recycle unit ratio is usually set about 6 mols (3 of hydrogen) per mol of naphtha. Space velocity is usually set at about 0.7 volumes of naphtha per hour per volume of reaction bed.

The reactor temperature is an important variable in controlling the reforming severity, and can range from 950°F to 1050°F. Space velocity can be used interchangeably with reactor temperature to attain the desired octane level.

Equipment—Since the kiln operates at essentially atmospheric conditions and the reactor at elevated pressures of between 100 and 200 psig, it is necessary to use a pressure lock system to inject the catalyst into the reactor. This pressure lock system operates on a batch principle, and is automatically controlled by a cycle timer. The reactor contains excess hopper space to permit variations in catalyst level without upsetting the process.

Catalyst flows from the reactor to a bucket elevator through a depressuring leg. This elevator raises the catalyst to the kiln. Another elevator moves catalyst from the bottom of the kiln to the reactor pressure lock system where the cycle is repeated.

Yields—Typical operation on 200-400°F straightrun naphtha yield 90% of a 10 lb RVP gasoline, while raising the leaded research octane from 63.2 to 96.7. However, advantage is taken of the excess hydrogen produced, and operation is maintained with a 50/50 mixture of straightrun and cracked stocks. The Commercial Yields table shows typical yields obtained when operating at the conditions shown above.

Installations—In 1954, two commerical units were built, one at the Beaumont, Texas, refinery of Magnolia Petroleum Co., and one at the Torrance, Calif., refinery of General Petroleum Corp.

Licensor—Process licensor for the Thermofor Catalytic Reforming Process is the Socony Mobil Oil Co., Inc., 150 E. 42nd St., New York 17, N. Y.

References—Articles published about the TCR process include the following:

(1) *Chemical Abstracts*, "Catalysis and Process for Reforming Hydrocarbons," U.S. 2,584,756, Feb 5, 1952, 46:P4213d

(2) *Chemical Abstracts*, "Hydrocarbon Reforming Catalyst," 1954 P2291a

(3) *Chemical Engineering*, "Thermofor Catalytic Reformer to Make High Octane Gasoline," 59:242-4 (Aug. 1952)

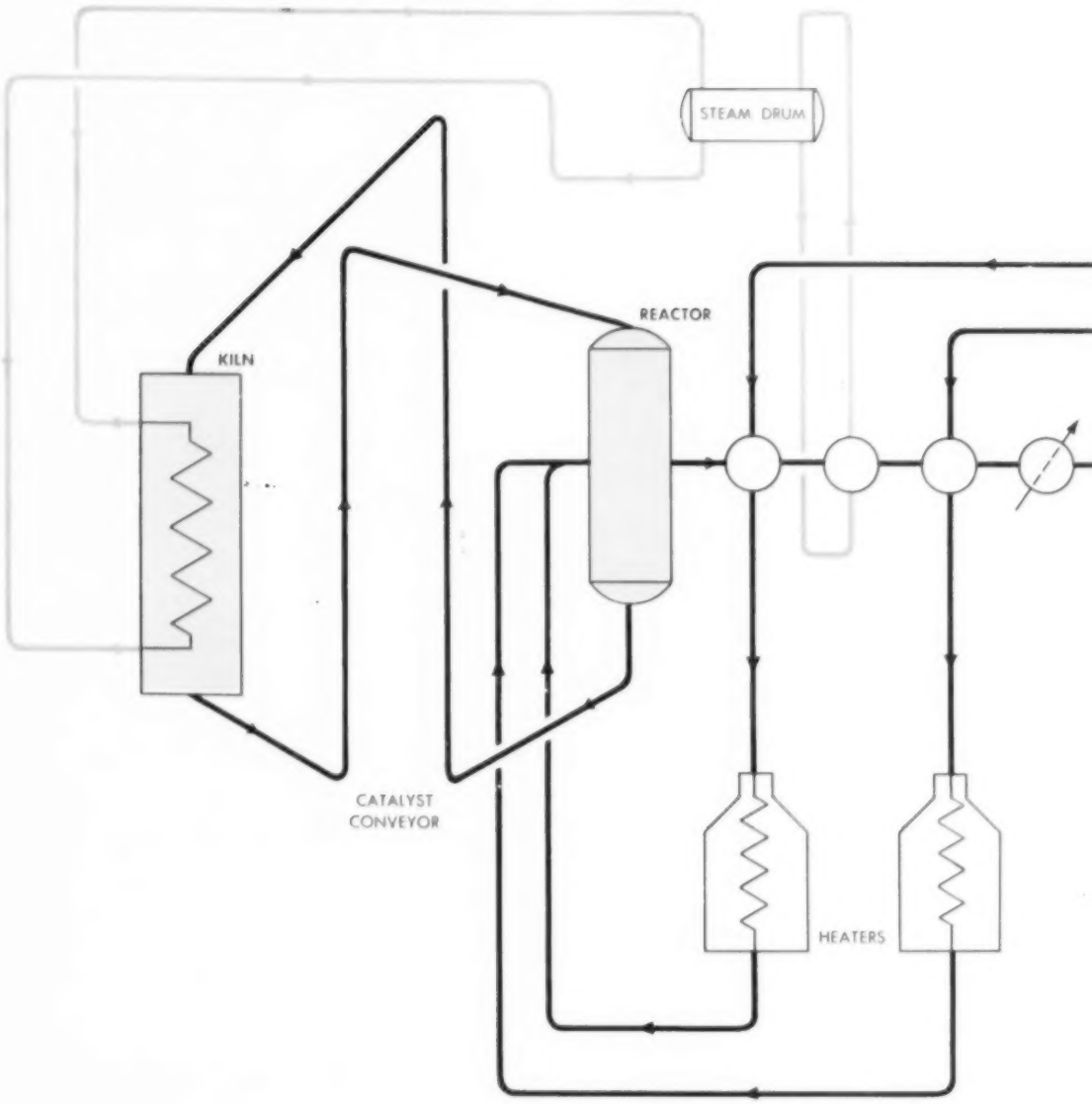
(4) *Oil & Gas Journal*, "Thermofor Catalytic Reforming—An Answer to Demand for Higher Octane Numbers," 51 (n.28):357, 360-2, 364-5, 367-8 (1952).

(5) *Oil & Gas Journal*, "Thermofor Catalytic Reforming Flow Diagram," March 21, 1956, pp. 142-3.

(6) Payne, J. W., Evans, L. P., Bergstrom, E. V., and Bowles, V. O., "Thermofor Catalytic Reforming," PETROLEUM PROCESSING, July, 1952, pp. 966-69.

(7) PETROLEUM PROCESSING, "Thermofor Catalytic Reforming," (Catalytic Reforming Special Report), Aug. 1955, pp. 1192-3.

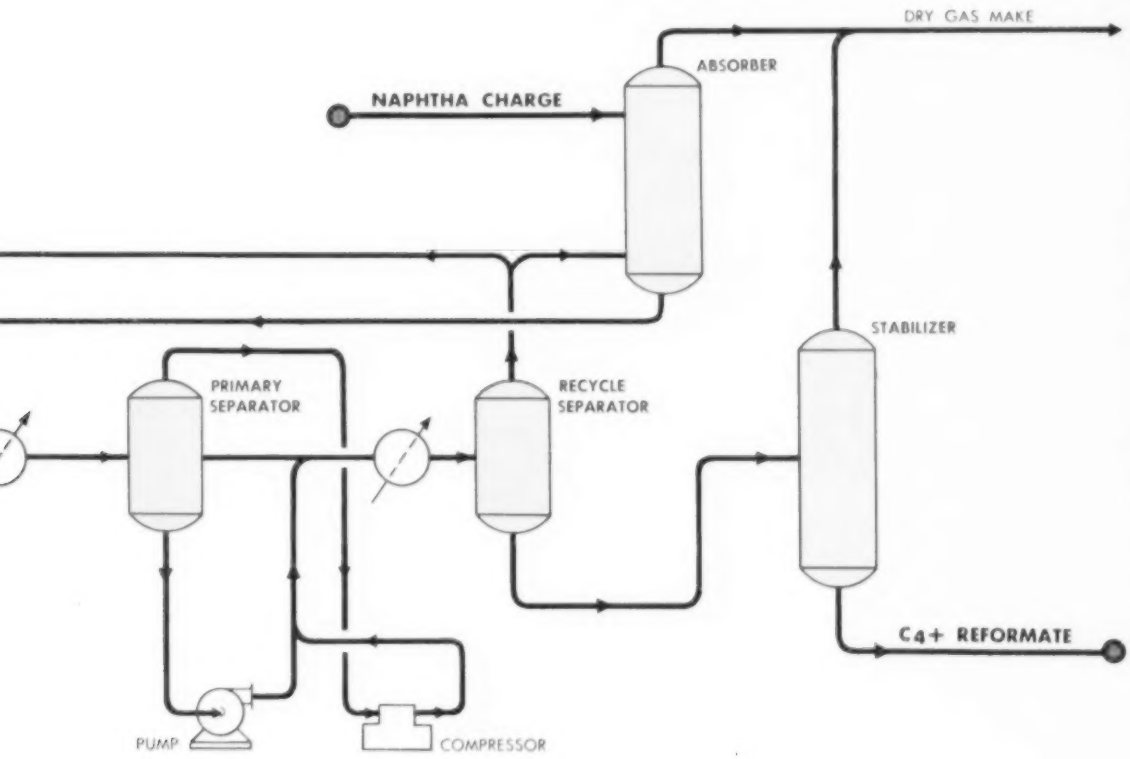
(8) *Petroleum Refiner*, "Thermofor Catalytic Reforming," (Process Handbook), Sept. 1956, pp. 216-7.



Commercial Yields from Thermofor Catalytic Reforming

(Operating conditions as shown in section entitled "Operating Conditions")

	Reformer Feedstock		Reformer Product Streams		
Properties—Feed & Product	**Straightrun Naphtha**	**Cracked Naphtha**	**Primary Reformate**	**Secondary Reformate**	**Polymer**
Gravity, °API	48.6	49.2	55.7	34.9	7.6
Reid vapor pressure, lb	3.0	0.6	5.8	0.5	
Initial boiling point, °F	171	238	118	295	448
50% point, °F	308	286	232	335	530
End point, °F	380	394	363	420	760
Sulfur, wt%	0.22	1.25	0.03	0.05	0.01
Olefins, vol%	0.5	39.7	8.8	3.7	
Aromatics, vol%	12.4	16.4	24.9	66.0	
Octane, Research + 3cc TEL	72.9	82.0	95.0	99.0	



Thermofor Catalytic Reforming

. . . Latest Data on Socony Mobil's Process

UNFOLD FOR START OF PROCESS DESCRIPTION

Yields and Gas Compositions for Thermofor Catalytic Reforming

(For case shown in table on preceding page)

Yields of Reformer Products	Vol%	Wt%
Primary reformate, as cut	54.8	—
Secondary reformate, as cut	28.7	—
C_4's	5.2	—
C_4-free reformate	81.3	—
Polymers	1.6	—
Total liquid recovery	88.1	—
Hydrogen sulfide	—	0.6
Dry Gas	—	10.4
Coke	—	0.8
Total Weight Recovery	—	100.0

Gas Composition	
Propanes & lighter	Wt%
Hydrogen sulfide	0.8
Hydrogen	4.0
Methane	21.5
Ethylene	0.2
Ethane	30.2
Propylene	0.8
Propane	42.5
Butanes	Vol%
Iso-butane	32.3
Butylenes	7.2
Normal butane	60.5

PROCESS CONTROL THROUGH REFRACTIVE-INDEX MEASUREMENT

Refractive index is directly related to the composition of a liquid mixture. The Consolidated-Phillips 38-201 Process Refractometer puts this basic principle to work . . . accurately and automatically indicates changes in composition by *continuously* measuring the refractive index of a flowing liquid sample and comparing it to a liquid standard. (Even complex streams can be monitored when all but one or two key components remain reasonably constant, and a binary mixture is thereby approximated.)

Samples may be obtained directly from the process stream to be controlled. Comparison signals from the instrument's optical-servo system are then used as part of a control loop to maintain optimum throughput and product quality and to keep processing costs at a minimum. For the complete story of the 38-201 Refractometer, send today for Bulletin CEC 1839-X27.

Send us your stream-analysis problems...

The Process Refractometer has been used successfully in the automatic control of many processes, e.g., fractionation and blending in the petroleum refining industry. Consolidated's Application Engineering Section will be glad to study your own stream-analysis problems and submit a complete report on the 38-201's applicability to your work. Just send us a description of your process . . . there's no obligation.

OPERATIONAL FEATURES

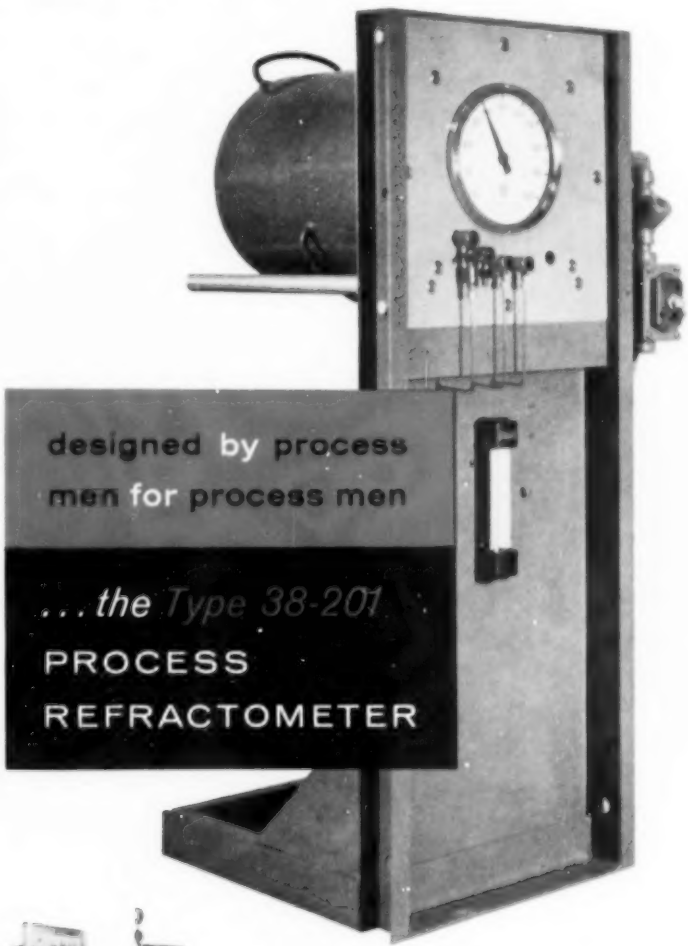
RUGGED CONSTRUCTION—explosion-proof design permits use anywhere, even out-of-doors.

STABLE, DRIFT-FREE OPERATION—the differential-principle design provides freedom from ambient temperature changes. Sample temperature, pressure and flow are closely controlled and stabilized.

HIGH SENSITIVITY—a difference of 0.000012 refractive-index units can readily be detected. Unit observes both plus and minus deviations of the flowing sample being monitored.

SIMPLICITY—contains no controls requiring routine adjustment; once unit has been placed in operation, the operator makes only an occasional inspection.

FREEDOM FROM MAINTENANCE—basic design simplicity keeps unit operating without attention for long periods.



OTHER CONSOLIDATED-PHILLIPS PROCESS-CONTROLLERS...

In addition to the Process Refractometer, CEC offers the 38-301 Oxygen Analyzer for monitoring and controlling oxygen content in gaseous streams and the 38-401 Ultraviolet Analyzer for checking purity and recovery of aromatic and diolefin streams.

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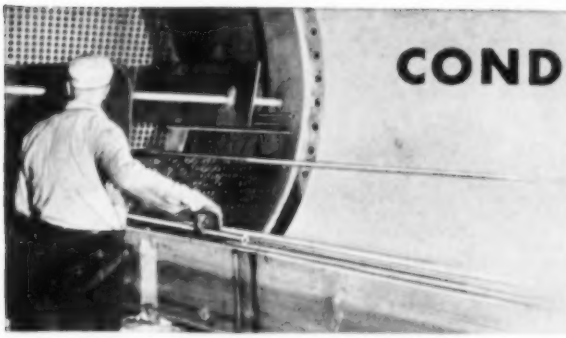
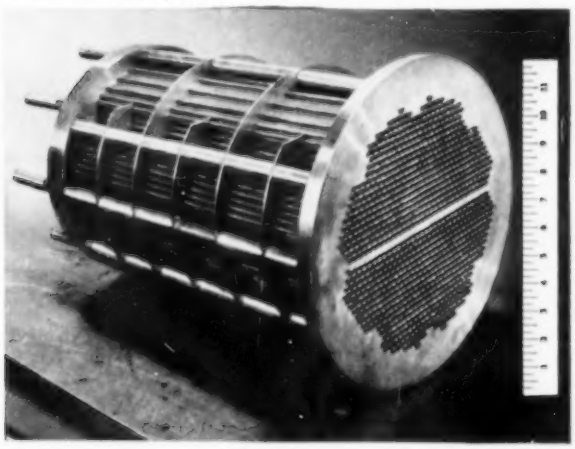


CONDENSER TUBE CLINIC

Edited by **JAMES T. KEMP**, Metallurgical Engineer,
The American Brass Company, Waterbury, Conn.

20" x ¼" O.D. Tubes need Same Care and Attention as large 60-foot Condenser Tubes

The Tube Bundle shown below is only 12 inches in diameter and 20 inches long. It is the heart of the compact, efficient lubricating-oil cooler built by the Andale Company, Lansdale, Pennsylvania.



In each bundle there are 946 tubes, each 20 inches long, ¼-inch O.D. by 0.035-inch wall thickness. They are of ANACONDA Phosphorized Arsenical Copper-108 for fresh-water duty or of ANACONDA Ambraloy-927 (Aluminum Brass), ANACONDA Cupro Nickel, 10%-755, or ANACONDA Cupro Nickel, 30%-702 for salt water. They are expanded in high-strength rolled ANACONDA Ambraloy-917 (Aluminum Bronze) tube sheets.

When the tubes are brass, the complete tube bundle is stress-relieved as an assembly at a temperature of 550 F.

These small tubes—cut to short lengths, with ends burnished, highly finished surfaces inside and out, close dimensional tolerances—are typical of The American Brass Company's product, although at the lower end of the schedule of sizes.

The Same Precision in control of alloy, dimensions, anneal or temper governs the manufacture of all ANACONDA Heat Exchanger Tubes in the plants of The American Brass Company—from these little oil-cooler tubes on up to the largest sizes used in sugar evaporators, and the long lengths needed in high-pressure feed-water heaters in steam power stations.

Full Range. ANACONDA Heat Exchanger and Condenser Tubes are made for all sizes and kinds of shell-and-tube, submerged, spray-tower, and finned-atmospheric heat transfer equipment—for operation at elevated temperatures in conformance with ASME standards for allowable stresses.

Technical Assistance. Our Technical Department is regularly helping manufacturers, electric companies, marine operators, petroleum and chemical companies to select the correct tube alloy for many types of condensers and heat exchangers. This service is available to you without obligation. Write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

ANACONDA®
Tubes and Plates
for Condensers and Heat Exchangers

PHYSICAL PROPERTIES OF ANACONDA CONDENSER TUBES*

ALLOY	Tensile Strength, psi	Yield Strength at .5% Elongation Under Load, psi	Elongation in 2", %	Rockwell Hardness, B Scale	Density, Lb per Cu. In.	Thermal Conductivity, B.T.U./Sq. Ft./In./Hr./° F. at 68° F.	Average Coefficient of Linear Thermal Expansion per °F. (77-572 F.)
Arsenical Admiralty-439	52,000	22,000	60	6-45	0.308	768	.0000112
Ambraloy-927	60,000	27,000	55	35-65	0.301	696	.0000108
Ambraloy-901	60,000	30,000	60	30-60	0.295	552	.0000099
Cupro Nickel, 30%-702	55,000	22,000	50	30-60	0.323	204	.0000090
Cupro-Nickel, 10%-755							
Light Annealed	44,000	22,000	46	25†	0.323	314	.0000093
Light Drawn	60,000	57,000	15	68†			
Red Brass-24	42,000	15,000	50	0-30	0.316	1104	.0000104
Ambronze-421	46,000	20,000	55	0-30	0.316	830	.0000102
Phosphorized Arsenical Copper-108							
Light Drawn	40,000	35,000	20	20-50†	0.323	1344	.0000098
Hard Drawn	54,000	50,000	8	50-70†			
Phosphorized Copper-103							
Light Drawn	40,000	35,000	20	20-50†	0.323	2364	.0000098
Hard Drawn	54,000	50,000	8	50-70†			

*Note: The above values are approximate and should not be used for specification purposes. *Light annealed except as noted.*

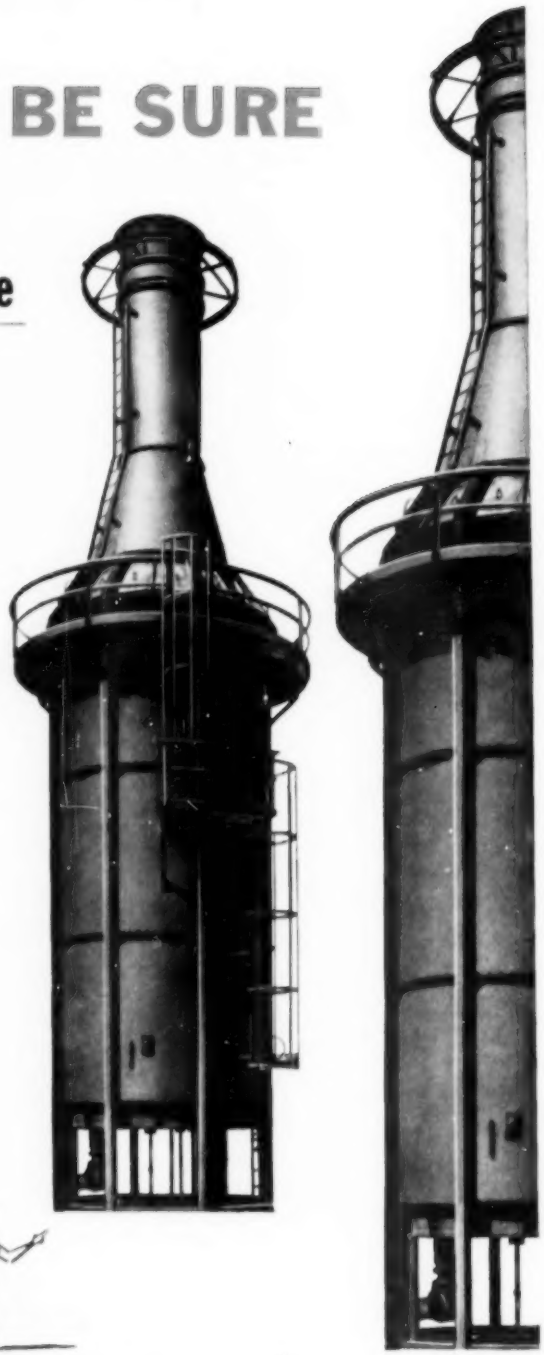
 (To obtain more data on advertised products see page 114)

YOU, too, CAN BE SURE

petrochem-isoflow furnaces

are most economically desirable

by any comparison



Whenever *all* the specifications and *all* the operating requirements are applied to direct-fired furnace design, you can be sure PETROCHEM-ISOFLOW FURNACES will be found most economically desirable, by any comparison.

In making comparisons it is essential to take these factors into consideration:

1—Average radiant transfer rate.
2—Maximum deviation from average radiant transfer rate.
3—Average and maximum transfer rate in convection section.
4—Maximum tube wall temperature, radiant or convection.
5—Maximum efficiency with specified excess air.
6—Controlled thermal recirculation of flue gases to provide even heat distribution throughout full length of each tube and equalized heat distribution around each tube.
7—Overload and corresponding transfer load.
8—Design to provide: structural column supports—Ladders—Platforms—Tube Removal facilities, etc.
9—Degree of assembly; of the furnace structure and of the heating surface.

When you specify PETROCHEM-ISOFLOW FURNACES . . . you'll be in good company. More than 1500 are now in service, performing to the complete satisfaction of their operators and usually well beyond their rated capacities.

PETROCHEM-ISOFLOW FURNACES

UNLIMITED IN SIZE . . . CAPACITY . . . DUTY

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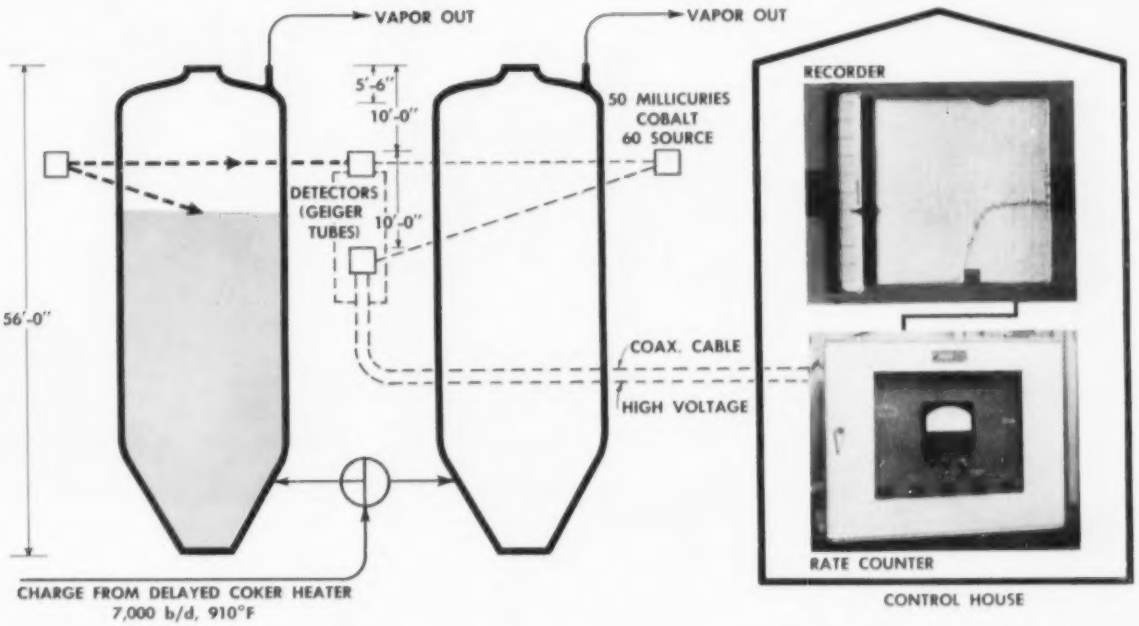


Gamma Rays Measure Coke Level

AT THE Oleum refinery of Union Oil Co. of California, radioactive cobalt makes it possible to operate a delayed coking unit at maximum unit throughput. Without interrupting operation of the coke drums, the level of the coke in each of the four drums can be measured quite accurately, thus permitting operating to the highest possible safe coke drum levels. The process is based on the absorption by the coke itself of the gamma rays emitted by the cobalt.

The delayed coking unit at Union's refinery has a battery of four coke drums, operated in pairs with one drum of each pair on stream at all times. By adjusting coking coil rates to give the maximum drum filling in the designated drum cycle, the maximum throughput of the unit is reached. Accurate measurement of the height of coke in each drum, before it is switched off, is possible by invisible but intense gamma rays which operate in the following manner.

A source of 50 millicuries of radioactive Cobalt 60 is mounted on each drum, 10 ft from the top head. Two Geiger-Mueller tubes are mounted as a unit for each pair of drums. One tube is 10 ft from the top head and the other one 20 ft from the top head. These two Geiger-Mueller tubes are connected in series to a rate counter that measures the total absorption of gamma rays from both tubes. This is recorded on a strip recorder chart mounted near the counter.

To obtain a measurement of the filling of the coke drum, the source of Cobalt 60 on the coke drum to come off-stream is opened. Then the Geiger-Mueller tubes on that pair of drums are connected to the counter and recorder. As the material in the drum exceeds the twenty foot level, radiation from the Cobalt 60 source is blocked from the lower Geiger-Mueller tube. As this happens, the gamma ray count gradually drops from a 80% value on the strip chart to about 40%, over a 45-min period. Again, when the coke in the drum reaches the 10-ft level, radiation to the upper Geiger-Mueller tube is blocked. Over a period of 20 minutes the value on the strip chart will gradually drop from about 40% to zero, and the drum is kept on stream one hour after reaching this zero count. Then, the indicator system and the charge from the delayed coker heater are switched to the next drum in sequence.

Coking coil rates are adjusted to give the maximum drum filling heights in the designated drum cycle. The operators adjust coil rates, depending upon the interval from the time a drum goes on stream until the rate counter indicates that the 20-ft level has been reached. Or, if required, the coil rates can be adjusted again, depending on the time needed to reach the 10-ft level. Thus by operating to the highest possible safe coke drum levels, Union Oil is able to reach maximum throughput on their delayed coking unit.

Water Injection Cuts Corrosion in Gas Coolers

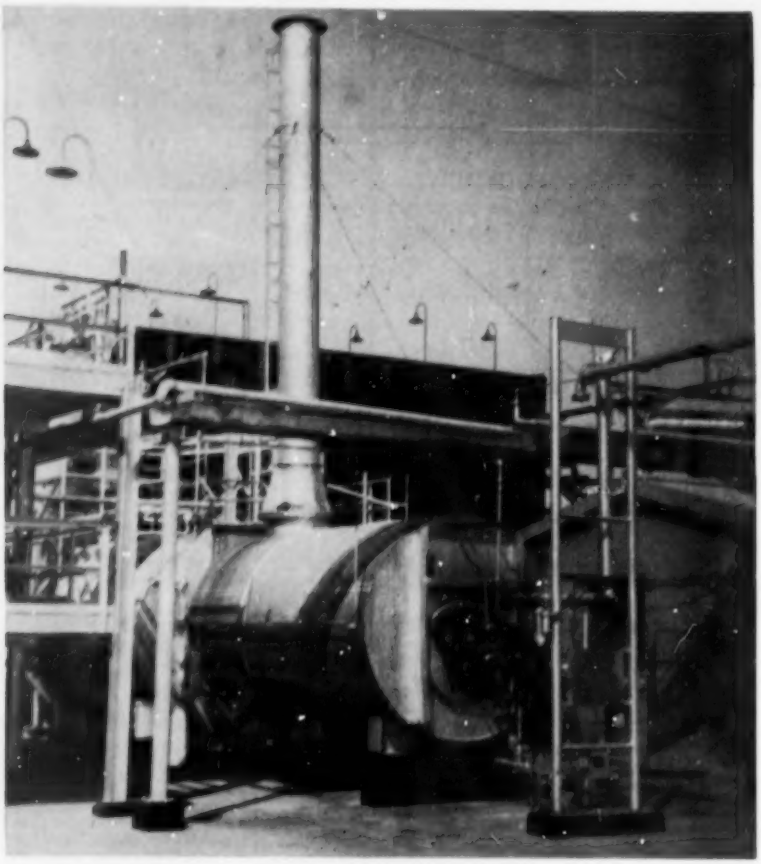
CONSTANT sources of corrosion trouble for gasoline plant operators in the East Texas field are CO_2 and H_2S of the casing-head gas. The worst trouble spot is in compression-type plants where the condensate is cooled after the initial two-stage compression.

At the Spear gasoline plant of the Gulf Oil Corporation at Kilgore, Texas, tubes in the aftercoolers had a life of about three months. Conventional ammonia and caustic injection were considered, but rejected because of the effect on brass tubes.

Cooling tower water here had a pH of 8.8—the compressed gas pH was 4.0. Injection of this water into the gas stream ahead of the coolers was tried and found to stop corrosion

completely. No attempt is made to meter the water and it is trapped out of the gas stream downstream of the coolers.

Tube life in the after coolers has been extended indefinitely. Instead of twelve re-tubing jobs for the entire plant per year, only three bundles were re-tubed in the first year of this operation—and all three were already corroded when water injection was started.



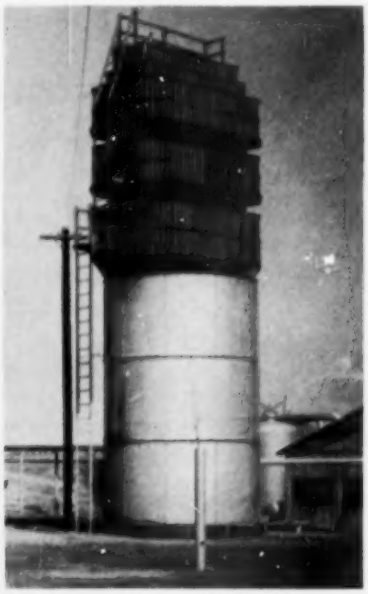
Simple Incinerator Replaces More Expensive Decomposer

TO REDUCE operating costs of its sulfur recovery unit, the Shamrock Oil and Gas Corp.'s McKee Plant, located near Sunray, Texas, substituted a simple plant-made incinerator for a more complicated and expensive decomposer. This switch in operating units sacrifices a very small conversion percentage of acid sludge but permits operating the recovery unit with 1 or 2 less men.

The decomposer was designed to operate by indirectly rotating heated sludge in the presence of seed coke. More coke is formed, and the sulfur compounds decomposed to sulfur trioxide and sulfur dioxide. These would then be sent to a final combustion chamber to convert all of the sulfur to sulfur trioxide.

By contrast, the plant-made incinerator burns sludge in a brick-lined chamber and converts the carbon and hydrocarbons to water and carbon monoxide or dioxide. The sulfur present in the sludge is converted to sulfur dioxide or sulfur trioxide gases, which are converted to sulfur trioxide in a final combustion chamber.

Air in the incinerator is supplied by a ½-in. line mounted at the same approximate location as the sludge inlet and fuel gas lines. Besides supplying air for combustion, the ½-in. air line assists in "spraying" the sludge into the combustion chamber.



Cooling Tower-Heating Tank Protects Gas Engines

CONSTANT temperature cooling water is needed to prevent damaging or breaking the blocks on hot Cooper Bessemer engines. At Dorchester Corp.'s Cargray natural gasoline plant, where these engines are used for various recompressor services, there is a special problem. In winter, the fresh well water may be lower than the required temperature and need heating before going to the engine cooling jackets. And in summer, fresh water temperatures—even when combined with recycle cooling water—will often exceed the maximum allowable jacket temperature.

To solve this problem at its natural gasoline plant near White Deer, Texas, the Dorchester Corp. combined a cooling tower with a storage-heating tank. This permits either heating or cooling the engine jacket water before it goes to the gas engines.

Hot cooling jacket water from the Cooper Besssemers is sent directly to a pit under the storage tank. This water from the pit can go directly to the storage tank, or can be bypassed to the top of the cooling water tower that is mounted on top of the storage tank. A temperature controller with a sensing element in the water line to the engine cooling jackets determines whether or not the pit water passes through the cooling tower.

The cold, fresh makeup cooling water from the well is heated to the desired temperature by mixing directly in the pit with the hot cooling water from the gas engines.

The Economical Solution

for BLENDING LIQUIDS • DISSOLVING SOLIDS IN LIQUIDS
MIXING GASES WITH LIQUIDS • AERATING • GASIFYING • OPERATED IN
ANY TYPE OPEN OR SEALED VESSEL

Struthers Wells

Agitator drives range in speed from 10 RPM to 500 RPM; from fractional to 50 h.p. with stuffing boxes or mechanical seals for pressures up to 500 pounds or more.

Quick opening manhole for inspection or filling.

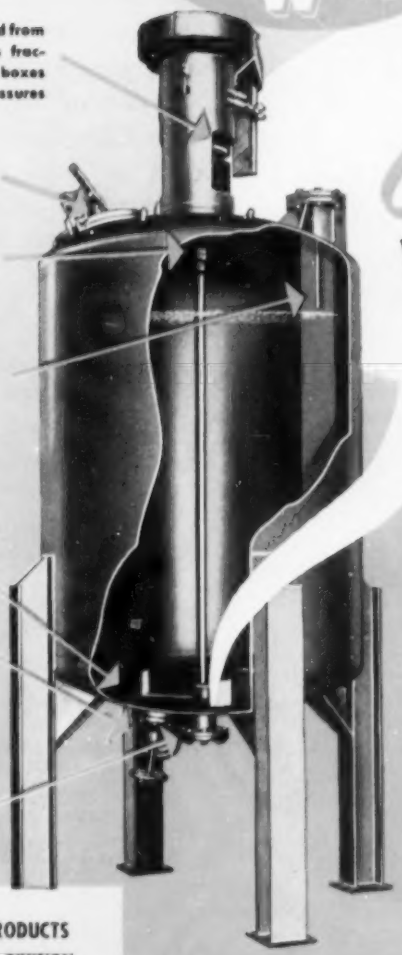
Semi-flexible coupling protects shaft bearings from bending movements.

Vertical baffles supported by a nozzle in the top head eliminating pockets in which materials may accumulate and providing easy outside adjustment.

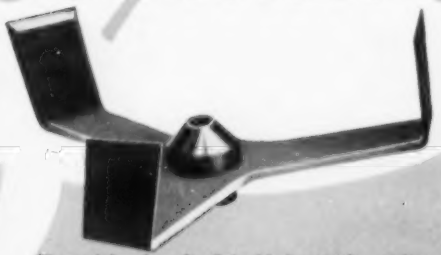
Radial propeller agitator is simple, efficient and self-cleaning.

Struthers Wells flush bottom valves are available in several sizes and materials.

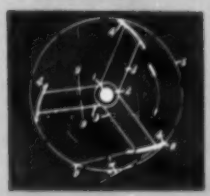
Removable bottom guide bearing simplifies maintenance.



RADIAL PROPELLER Agitator



The peripheral angle of the blades can be made to meet any requirement.



The illustration at left shows the Struthers Wells Radial Propeller Agitator mounted in a heavy-duty stainless steel mixer. Radial Propeller Agitators are available in all commercial sizes and materials, and can be specifically designed for any practical liquid agitating requirement.

Write for Bulletin 58-W

STRUTHERS WELLS PRODUCTS

PROCESSING EQUIPMENT DIVISION

Crystallizers . . . Direct Fired Heaters . . . Evaporators . . . Heat Exchangers . . . Mixing and Blending Units . . . Quick Opening Doors . . . Special Carbon and Alloy Processing Vessels . . . Synthesis Converters

BOILER DIVISION

BOILERS for Power and Heat . . . High and Low Pressure . . . Water Tube . . . Fire Tube . . . Package Units

FORGE DIVISION

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MACHINERY DIVISION

MACHINERY for Sheet and Structural Metal Forming . . . Tangent Benders . . . Folding Machines . . . Roller Table and Tumble Die Bending Machines . . . Press Brakes . . . Punching and Notching Machines . . . Forming Dies

STRUTHERS WELLS *Corporation*

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Plants at Warren, Pa. and Titusville, Pa.

Offices in Principal Cities

 (To obtain more data on advertised products see page 114)

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How the Old Man Saved Our Christmas Eve

"That unit's gonna run tomorrow night . . . Christmas Eve or not!"

WE WERE just finishing a big turnaround and the Bull Pen was unusually quiet for coffee time. A few operators, a few foremen, a new engineer in the inspection department, and myself. I like my coffee. The talk bandied around the turnaround and how well it had gone off this time and how we hoped there would be no call-outs when the unit started up tomorrow night. After all, it was Christmas Eve.

One of the jobs we had put in this time was a larger water wash line to the top tray section of the caustic wash tower. Seems that the tower kept plugging up with carbonates in spite of all the operators could do. The simplest way to clear the tower was to take it out of service and flush it with water until it was clean—but it took about 48 hours to clean it through the 3-in. line, and the unit couldn't spare the tower that long at a time. So, we replaced the 3-in. line with a 6-in. To do this, we had to change the nozzle in the tower.

"Good fit on the fabricated pipe for that new line on the caustic tower."

"Yeah, that's a change."

The young fella from the inspection department chimed in, "How did you stress relieve that nozzle on the tower?"

I looked at Dan, the area engineer—he got caught in the middle of a big swig of hot coffee and near choked to death. We hadn't stress relieved the nozzle! Everybody had just plain forgot it! It's one of those things that sometimes happen in our plant (and probably every other plant). In spite of all the elaborate plans we make, some little overlooked detail will trip us up occasionally.

I didn't know whether to hit that young fella or thank him. We all knew it was a coded vessel and the connection would have to be stress relieved—and field stress relieving is always a disagreeable proposition.

"We'd better get that rented stress relieving machine out of the shop right away and get started," I said.

"Hell, we sent that thing back a week ago," Dan answered.

Well, you can imagine how I felt. "That unit's gotta go on tomorrow night."

"If it does, it'll go on without that nozzle being stress-relieved. We can never do a good job with torches, and that's the only other way I know of."

I'd been thinking about looking for a new job anyway, so I figured the Old Man would help me make up my mind. I went up and laid it out for him.

"And just where have you been?" I could see he was going to blow up any minute. The Old Man is a professional at chewing people out—I was going to have plenty of time to look for a new job.

Then he settled down. "That unit's gonna run tomorrow night and you're gonna stress relieve that nozzle in plenty of time."

"Me?" I asked. "How? We've never had much luck with torches."

"Don't need torches. I'll tell you how you're gonna do it."

By next morning we had everything set up. We installed all our thermocouples around the nozzle, both inside and outside the vessel, and wired them to a temperature recorder. The insulators then insulated the inside of the vessel and nozzle. In the meantime, we cut the top off a 55-gal drum and cut out one side of the drum to fit the curvature of the tower. Then, the drum was fitted to the side of the tower over the area we wanted, and secured there with cables and braces. We were ready for business.

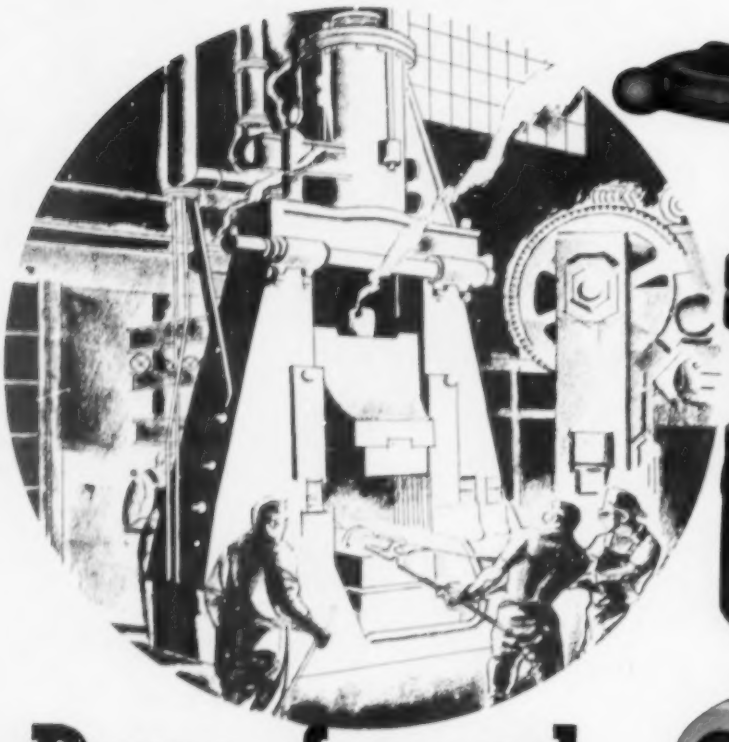
The old drum was loaded with coke and our "stress-relieving furnace" was fired up. We'd put an air connection in the bottom of the drum for draft and the "furnace" fired just right. The temperature shot up on the recorder. After fiddling with it for a few minutes we found we could control the rate of temperature rise almost to a degree by adjusting the air supply and the vent holes.

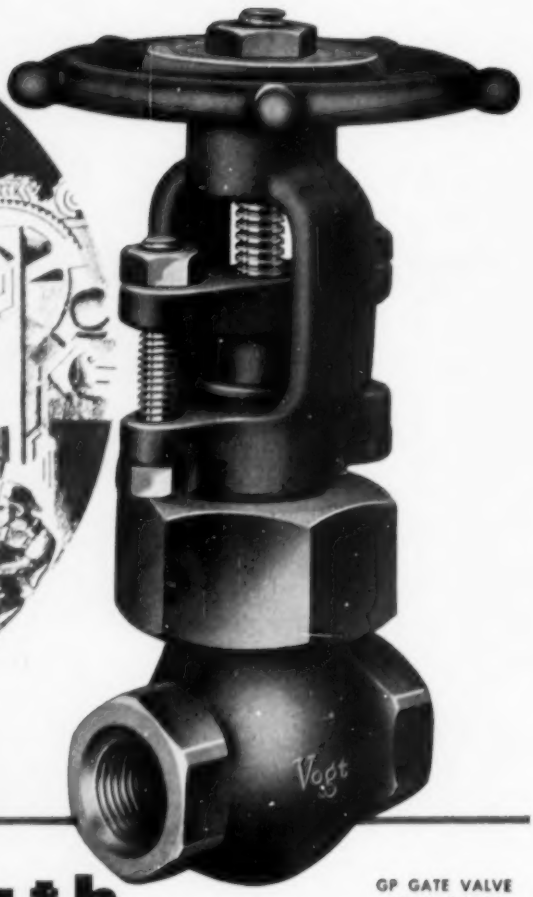
You never saw a prettier, straighter temperature curve in your life. When we got close to the relieving temperature, we started to slow the thing down and level out. Holding the soaking temperature was tricky, but we got a good curve and held it for about two hours.

Bringing the temperature down was the easiest part of all. We simply cut off the air, plugged the vents, and let the fire die. The temperature came right down that 200°-an-hour rate.

By three o'clock, we were all through, and the tower was cleaned out and ready to go. Our Christmas had been saved.

We don't often have to cut into vessels like this, but when we do, I'm not too sure we won't use the "barbeque pit" stress-reliever again.





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for Strength and Safety

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SERIES 5-9530

Drop forging techniques, resulting from more than a half century of pioneering and development by Vogt in the production of forged steel valves, impart matchless strength and safety to the new line of Vogt GP Valves. Made from killed, clean, fine grained open hearth steel billets, forging and treatment operations result in additional grain refinement and increased toughness.

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DROP FORGED STEEL

VALVES

Do You Know These Words?

By B. H. WEIL
Manager, Information Services
Ethyl Corp. Res. & Engrg. Dept.
Detroit, Mich.

A regular department intended to help both administrators and operating men keep abreast of technical names and processes in the petrochemical field.

Chlorosulfonated Polyethylene

Chlorosulfonated polyethylene, pronounced "**klo**-row-**suhl**-fah-nated **pahl**-ih-**eth**-ih-lean," is the newest of the synthetic rubbers to approach commercial production, under the trade-name "Hypalon." The raw polymer for this rubber comes in the form of white, solid chips, slightly heavier than water in unit weight.

This polymer is a derivative of polyethylene, in which the long chains of ethylene molecules ($-CH_2-CH_2-$) have been modified by reaction with chlorine and sulfur dioxide. These introduce chlorine atoms into several positions on the chains (about one for each seven carbon atoms), and—more importantly—attach a chlorosulfonyl group ($-SO_2Cl$) to about one carbon atom in every 85 (the typical chain apparently contains about 1445 carbon atoms). These latter reactive groups make it possible to vulcanize the raw polymer—to cause further interaction among chains (in the presence of properly selected compounding ingredients) in order to produce a rubberlike material instead of a plastic.

Chlorosulfonated polyethylene rubbers have excellent tensile strength, good resilience and electrical characteristics, low compression set, and unlimited colorability (being white to begin with). Uses include acid hose, spark-plug boots, tank linings, protective coatings, hot-materials belts, gaskets and packings, and other applications which take advantage of this rubber's outstanding resistance to heat, weather ozone, and many chemicals.

This new synthetic rubber is a definite member of the petrochemical family, being derived from petroleum-based ethylene (from cracked refinery gases or the deliberate cracking of ethane, propane, gas oils, etc.) Its commercial production is another evidence of the diverse nature of the synthetic-rubber field, in which new materials can still make a place for themselves (in competition with natural or GR-S elastomers) on the basis of outstanding properties.

Cresylic Acid

Cresylic acid, pronounced "kreh-**sill**-ik **ass**-id," is a mixture of monohydric phenols (phenols containing only one -OH group per molecule). "Crude cresylic acid" is essentially a mixture of cresols and higher-boiling phenolic materials (xylenols, etc.), and is of lower phenol content than crude carbolic acid. The refined cresylic acids are variously defined as mixtures of *o*-, *m*-, and *p*-cresols (sometimes called "cresol") or as mixtures of phenolic materials largely boiling above the cresol range. In other words, cresylic acids contain phenol (C_6H_5OH), cresols ($CH_3C_6H_4OH$) and xylenols [$(CH_3)_2C_6H_3OH$] in varying proportions. The mixture of the cresols, for example, is a yellow to brownish-red liquid of high boiling range, slightly heavier than water, which solidifies at room temperatures.

Depending upon their exact constitution, the cresylic acids are used for the manufacture of tricresyl phosphate and other chemical intermediates, synthetic resins, disinfectants, flotation agents, metal-cleaning compounds, petroleum additives, detergents, etc., and in the solvent refining of lube oil. The cresylic acids were historically derived from coal tar, but a large percentage of production now comes from petroleum; the source has some effect on the uses.

Petroleum cresylic acids are recovered from cracked distillates, such as heavy catalytic naphthas and cracked heating oils, by treating with dilute caustic soda, followed by purification of the extract to give a marketable product. One new plant will reportedly produce them, along with phenol and specific cresols, from the spent caustic wash or cresylic acid sludges obtained from a number of eastern-seaboard refineries.

New uses for the cresylic acids continue to be found, and add to the market potential for these substances. Here is another instance of increasing petrochemical dominance of a former coal-tar field.

NEWS in VIEWS

GOING UP FAST at Firestone Tire & Rubber Co.'s soon to be completed Orange, Texas, butadiene plant are these huge, 87-ton reactors, part of the 40,000 t/yr facility expected to be ready in early 1957.

Typical HARSHAW CATALYSTS

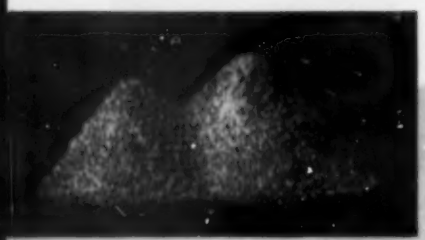
and How they are Used

TABLETED

EXTRUDED

SPHERICAL

GRANULAR



POWDERED

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"HARSHAW CATALYSTS"

DEHYDROGENATION CATALYSTS

CHROME-ALUMINA—available in powder or tablet form containing various percentages of chromium oxide supported on high surface area alumina—can be supplied as promoted catalyst and is also available as screened granules.

IRON—tableted iron oxide.

REFORMING CATALYSTS

MOLYBDENA-ALUMINA—supported molybdenum oxide on alumina—available as microspheres for fluid techniques, or as tablets for fixed bed application.

COBALT MOLYBDATE—a supported cobalt oxide—molybdenum oxide catalyst supplied in tablet form.

NICKEL-ALUMINA—a spherical catalyst available as hard spheres measuring ⅛″ to 1″ diameter—used for some types of gas reforming.

DESULFURIZATION CATALYSTS

COBALT MOLYBDATE—a supported cobalt oxide—molybdenum oxide catalyst supplied in tablet form.

ZINC OXIDE—a pelleted zinc catalyst used in the desulfurization of natural gas.

MOLYBDENUM SULFIDE—powdered and tableted molybdenum sulphide.

CHLORINATION CATALYST

COPPER—supported copper catalyst prepared and shipped as tablets or granules.

HYDROGENATION CATALYSTS

NICKEL-KIESELGUHR—supplied as unreduced, or reduced and stabilized, tablets, ⅛″ to ⅝″ diameter.

NICKEL-ALUMINA—available in tablet form containing nickel as nickel oxide on high surface area alumina, or in spherical form supported on low area, high-fired alumina.

RUFERT FLAKES—reduced nickel protected by hardened oil shipped as free-flowing flakes for hydrogenation of all glyceride and acid fats.

COPPER-CHROMIUM OXIDE—shipped as powder or tablets, stabilized or non-stabilized, with varying ratios of copper oxide to chromium oxide.

NICKEL-ALUMINUM—powdered 50:50 alloy used for preparation of active nickel catalyst for low temperature hydrogenation.

CATALYSTS FOR ORGANIC SYNTHESES

ZINC CHROME—a tableted zinc oxide—chromium oxide catalyst used in the synthesis of methanol.

MERCURIC CHLORIDE—a granular catalyst consisting of mercuric chloride on active, granular carbon used in the synthesis of vinyl chloride monomer.

COBALT THORIA—available as powder or tablets, a thoria promoted cobalt catalyst employed in Fischer-Tropsch synthesis.

COBALT—a supported cobalt catalyst in pellet form used in the synthesis of hydrogen sulfide.

DEHYDRATION CATALYST

ALUMINA—powdered and tableted aluminum oxide supplied as an active, intermediate surface area catalyst.

Whether your requirement is measured in tons or pounds Harshaw can produce your catalyst exactly to your specifications of raw materials, chemical composition, and physical properties such as length, diameter, crushing strength, abrasion resistance, and bulk density. AND, make delivery when you want it. Call on Harshaw today—for further information or technical assistance.

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Petroleum Processing's Clip-n-File ENGINEERING DATA SHEET No. 12

Glossary of Alloys

Alloys are intimate combinations of two or more metals, many of which are as historical as bronze. Some alloys have been, and are still being developed for special uses, i.e., gas turbines, nuclear reactions.

Until a few years ago alloys were made by melting together two or more metals. But now this initial combination may be made, also, by powder metallurgical techniques.

The following list of the more common alloys include both general names and *trade names* (in italics) of alloys used in refinery and petrochemical plants.

Alloy...	Made By...	Is Used For...	And Is Composed of...
Abyssinian gold	(many companies)	Marine parts, condenser tubes, impellers, "gold" decoration	5-10% aluminum in copper
Admiralty metal		Condenser and heat exchanger tubing	71% copper, 28% zinc, 1% tin
alclad		Resistance to corrosive conditions	Coating of high-purity aluminum over wrought aluminum or alloy
Alnico	General Electric Co., and its licensees	Permanent magnets	Various combinations of aluminum, nickel and cobalt
Alumel	Hoskins Mfg. Co.	Thermocouples and lead wires	About 94% nickel, with small amounts of aluminum, manganese, and silicon
Ardal Metal	Ardal Ltd.	Bearings, pistons, wire	Aluminum alloy with 2% Cu, 1.7% Fe, and 0.6% Ni
Babbitt metal		Bearings	Tin or lead base, with varying amounts of antimony and arsenic
Balco	Wilbur B. Driver Co.	Thermometer bulbs	70% nickel, 30% iron
Beraloy	Wilbur B. Driver Co.	Diaphragms, springs, electr. contacts	Copper alloyed with 1-2% beryllium
Bethalloy	Bethlehem Steel Co.	Tools and dies	Steel with 0.75 C, 0.75 Mn, 0.90 Cr, 1.75 Ni, 0.35 Mo
brass		Nuts and bolts, tubing, valves	Copper-zinc alloy, with some lead or tin content (1-3%)
bronze		Pipe, valves, bushings, gears	Copper-tin alloy, with some lead or zinc content
67 Chisel	Bethlehem Steel Co.	Shock resisting tools	Steel with 0.50 C, 0.75 Si, 1.15 Cr, 0.20 V, 2.50 W
Chlorimets	The Duriron Co., Inc.	Hydrochloric and sulfuric acid	Nickel-base alloys
Chromax Castings	Driver-Harris Co.	Furnaces and chains	Ferrous alloys with Ni and Cr
Chromel	Hoskins Mfg. Co.	Heating elements, rheostats	Nickel, chromium and iron
Cobentum	Wilbur B. Driver Co.	Springs; and corrosive conditions	40% cobalt, 20% nickel, 15% molybdenum, 7% manganese, 2% beryllium, 0.40% C; iron, balance
Comokut	Bethlehem Steel Co.	High speed tools	Steel with 18% tungsten (W), 4.50% Cr, 1.25% V, 5% Co
Constantan		Thermocouples and resistors	43% nickel, 57% copper
Copel	Hoskins Mfg. Co.	Electrical resistor for low temp.	55% copper, 45% nickel
Cupron	Wilbur B. Driver Co.	Rheostats and electrical resistors	45% nickel, 55% copper
Dowmetal	The Dow Chemical Co.	Lightweight and corrosion resistance	85% or more of magnesium
Duralumin		Machinery and boat parts resistant to acids and sea water	Aluminum with 4% Cu, 0.5% Mg, and 0.25-1.0% Mn
Durochrome	Thompson Products, Inc.	Valve seat inserts	Si-Cr-Mo alloy cast iron
Duranickel	International Nickel Co.	Corrosion resistance	Wrought alloy with 94% nickel
Durco	The Duriron Co., Inc.	Resistance to acids	Cast steel alloys (a series)
Durichlor	The Duriron Co., Inc.	Resistance to hydrochloric acid	Iron with 14.5% Si, 0.85% C, 0.65% Mn, and 3.0% Mo
Durimet	The Duriron Co., Inc.	Sulfuric and other acids	Iron with Ni-Cr-Cu-Mo-C
Duriron	The Duriron Co., Inc.	Most acids and salts; *not* alkalies	Iron with Si-C-Mn
Duronze	Bridgeport Brass Co.	Tanks, gears, hardware	Copper with 2-3% Si and Al
Easy-Flo	Handy & Harman	Brazing gas-tight joints	50% silver, and Cu-Zn-Cd
Elcomet	LaBour Co.	Valve and pumps	Nickel-chrome iron alloy
elinvar		Thermostats, metal-to-glass seal; has constant modulus elasticity	Iron, with 36% Ni and 12% Cr
Elkonite	P. R. Mallory Co.	Valve seats, bearings	Sintered tungsten-copper alloys
Enduro	Republic Steel Co.	Furnace parts, and general corrosive conditions	A series of stainless steels resistant to high temperatures
Evanohm	Wilbur B. Driver Co.	Precision wound resistors	75% Ni, 20% Cr, 2.5% Al, 2.5% Cu
Everdur	American Brass Co.	Corrosion resistance	Copper-silicon alloys
Fahralloy	American Manganese Steel	Acid pumps	Chromium-nickel alloys
Fahrite	Ohio Steel Foundry Co.	Furnace parts	Hi-chromium nickel steel
Frary metal		Bearings	Lead with 1-2% of Ba and Ca
Galvo-Link, -mag, -pak, -rod	Dow Chemical Co.	Cathodic protection	Magnesium alloy or metal
German silver (nickel silver)		Screws, name plates	Copper base with 18% nickel and 17-27% zinc
Graphalloy	Graphite Metallizing Co.	Self-lubricated bearings, electrical brushes and contacts	Graphite impregnated with a metal or alloy

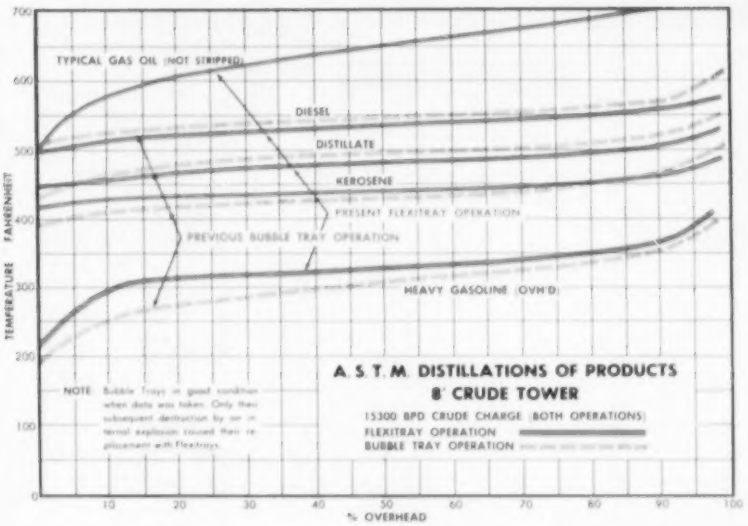
ALLOYS, GLOSSARY OF

Alloy ...	Made By ...	Is Used For ...	And Is Composed of ...
Hadfield's manganese steel	———	Drilling, and material-handling where severe wear is expected	Austenitic steel with about 1.2% C and 12% Mn
Hascrome	Union Carbide and Carbon	Facing wear-resistant parts	Iron with Cr-Mn
Hastelloy	Union Carbide and Carbon	Pumps, tanks, autoclaves, heat exchangers, etc.	Nickel-iron alloys with Mo, Si, Cu
Haynes Stellite	Haynes Stellite Co. (Div. of Union C. & C.)	Hard facing parts subject to heat, abrasion, erosion	Cobalt base with Cr and W (tungsten)
Haystellite	Haynes Stellite Co.	Hard facing equipment	Tungsten carbide
Herculoy	Revere Copper & Brass	Tanks, blowers, nuts and other equipment for chemicals	Non-magnetic silicon bronze
Hy-ten-al	American Manganaese Bronze Company	Heavy duty gears, bearings, valves, worm wheels	Bronzes with 60-68% Cu, 20-24% Zn, 3-7% Al, 2.5-5% Mn, 2-4% Fe
Illium	Burgess-Parr Co.	Acid pumps, tanks, valves, spray nozzles, bearings	Nickel alloys of 22.5% Cr, 6.5% Fe, 6.5% Cu, 6.4% Mo and small amounts of Al, Mn, Si and C
Inconel	International Nickel Co.	Corrosion resistance at high temperatures	About 78% Ni, 15% Cr, 6% Fe
Invar *(Nilvar)*	———	Accurate moving parts where expansion with temperature is undesirable	Iron and 36% nickel, with minor amounts of Mn, Si and C
Kanigen	General American Transportation Corp.	Valves, pump parts, vessels, exchangers, and processing equipment for corrosion protection	A nickel-phosphorus coating chemically deposited on alloys of iron, copper, nickel, and aluminum
Incoloy	International Nickel Co.	Hydrogen and ammonia plants	Iron with 32½% Ni, 2% Cr, 0.75% Mg
Kelcaloy	M. W. Kellogg & Co.	Pressure vessels	Iron base-alloys clad on steel or iron plate
Kennametal	Kennametal Inc.	Cutting tools and wear resistance	Cemented carbides of titanium and tungsten carbide.
Kentanium	Kennametal Inc.	Turbine blades, valve seats, flame tubes, bearings requiring high strength at high temperatures	Titanium carbide alloys
K Metal (Konel)	Westinghouse Electric Co.	Special valves and turbine blades with high strength at high temp.	Ni-Co-Ti alloy with Si-Al-Mn
ledloy steels	———	Faster machining	Steels with small (0.25%) quantity of added lead
Lo Cro	Crucible Steel Co. of America	High temperature bolts	Steel alloys with 5% Cr, and sometimes 1% W and 0.5% Mo
magclad	———	Resisting atmospheric corrosion	Magnesium alloy sheet clad with layers of anodic magnesium alloy
Manganin	Wilbur B. Driver Co.	Resistors, potentiometers	Copper, manganese and nickel
Mayari	Bethlehem Steel Co.	High temperature corrosion resistance and wear	Steel with 1% Ni, with varying amounts of Cr, Ti, W, Mn, Si
Misco	Michigan Steel Casting Co.	Furnace parts, valves, stills	Hi-chrome stainless steels
mischmetal	———	Alloy improver, lighter flints	Rare earth metals, about 50% cerium, with La-Nd-Pr-Sm
Monel	International Nickel Co.	Corrosion resistance with acids, alkalies, brines and water	67% Ni, 30% Cu; remainder is iron and manganese
Multimet	Union Carbide & Carbon	Rotors, turbines, high-temperature bolts, nozzles	Iron-base alloy
Muntz Metal	———	Condenser plates, evaporator and heat exchanger tubing, valve stems	60% copper, 40% zinc
Nichrome	Driver-Harris Co.	Heating elements, rheostats	60% Ni, 24% Fe, 16% Cr, 0.1% C
nickel silver	———	Resistance to acids	Copper alloys with 17-32% Zn and 10-30% Ni
Ni-Resist	International Nickel Co.	Resistance to sulfuric acid	Cast iron with 14-30% Ni, 4-7% Cu, 0.5-3.5% Cr, and 1% Mo
nitralloy (nitrided steels)	———	Parts subjected to wear and mild corrosive conditions	Alloy steels containing aluminum and treated with ammonia gas for surface hardening
permalloy	———	Magnets with high permeability	Nickel alloy with about 20% Fe
perminvar	———	Magnets with high permeability	Nickel alloy with 22.5% Fe, 7.5% Co
pyrophoric alloys	———	Welding and other lighters	Iron-ceriuem alloys
red brass	———	Heat exhangers, piping	85% Cu, 15% Zn
Resistac	Amer. Manganese Bronze Co.	Valve seats and guides	Copper with about 10% Al, 1-5% Fe
Rodar	American-La France Corp.	Sealing metal to hard glass	Iron-nickel-cobalt alloy
Silmanal	General Electric Co.	Permanent magnets, cold worked	87% Ag, 9% Mn, 4% Al
Stellite	Union Carbide & Carbon	Valves, tools, and hard-facing	Cobalt base with Cr and W
Tobin bronze	———	Brazing rod, pumps, valves	6% Cu, 39% Zn, 1% Sn
Toncan Iron	Republic Steel Co.	Piping	Iron with 0.4% Cu and 0.7% Mn
Wood's metal	———	Sprinkler systems (lo-melting point)	Alloys of cadium and bismuth
Worthite	Worthington Corp.	Pumps and valves in acid service	Stainless steel with 20% Cr, 24% Ni, 3% Mo, 3.25% Si, 1.75% Cu, 0.06% Mn, and 0.07% C
Y alloy	———	Castings	Aluminum with 4% Cu, 2% Ni, 1.5% Mg
Zamak	New Jersey Zonc Co.	Die castings	High purity Zn with Al, Mg, Cu

Note: Names of alloys in italics are trade names

Why Top Performers Prefer

KOCH Flexitrays FOR CRUDE PETROLEUM DISTILLATION

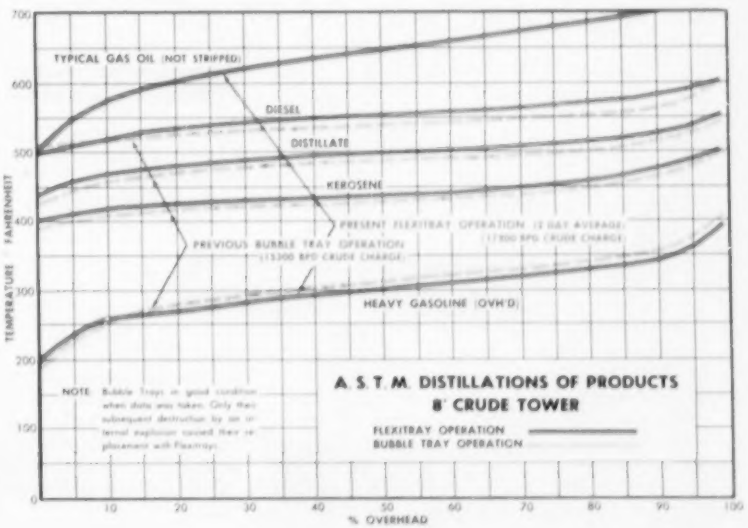

TYPICAL GAS OIL (NOT STRIPPED)
DIESEL
DISTILLATE
KEROSENE
PRESENT FLEXITRAY OPERATION
PREVIOUS BUBBLE TRAY OPERATION
HEAVY GASOLINE (OVH'D)
TEMPERATURE FAHRENHEIT
% OVERHEAD
A. S. T. M. DISTILLATIONS OF PRODUCTS
8' CRUDE TOWER
15300 BPD CRUDE CHARGE (BOTH OPERATIONS)
FLEXITRAY OPERATION
BUBBLE TRAY OPERATION
NOTE Bubble Trays in good condition when data was taken. Only their subsequent destruction by an internal explosion caused their replacement with Flexitrays.

The superior efficiency of the Flexitray at maximum bubble tray capacity is illustrated in the adjacent graph. The bubble tray ASTM's are indicating deterioration of quality and yield due to the presence of "End Point Tails." No such loss of efficiency is indicated by the Flexitray operating under identical process and thruput conditions.

←

The adjacent graph illustrates results with Flexitrays operating at some 11% above the "practical" capacity of bubble trays. Note that at this higher thruput the Flexitray is producing products of comparable quality to that of the bubble tray at a lower rate of thruput. The performance records of the Koch Flexitray are outstanding. Wire, write, or phone us on its application to your problem.

→


TYPICAL GAS OIL (NOT STRIPPED)
DIESEL
DISTILLATE
KEROSENE
PRESENT FLEXITRAY OPERATION (2 DAY AVERAGE) (15300 BPD CRUDE CHARGE)
PREVIOUS BUBBLE TRAY OPERATION (15300 BPD CRUDE CHARGE)
HEAVY GASOLINE (OVH'D)
TEMPERATURE FAHRENHEIT
% OVERHEAD
A. S. T. M. DISTILLATIONS OF PRODUCTS
8' CRUDE TOWER
FLEXITRAY OPERATION
BUBBLE TRAY OPERATION
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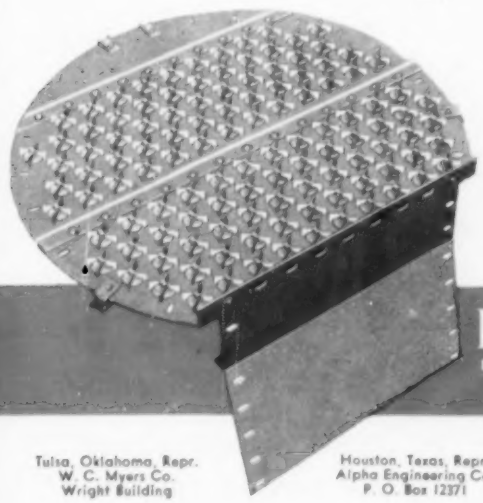

KOCH ENGINEERING COMPANY, INC.

DESIGNERS AND FABRICATORS OF MODERN TRAYS

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Crawford Engineering Co.
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FISHER®

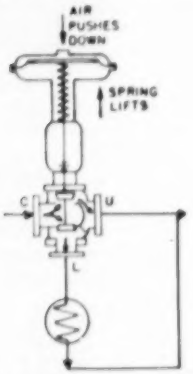
THREE-WAY DMVS

FOR

BY-PASS, MIXING or BLENDING SERVICE

TYPE 657-YY

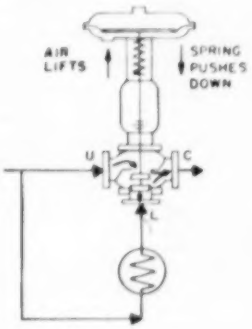
Three-way control valve for by-pass or proportioning service. Available all castable alloys sizes ½ thru 12".



By-pass flow is from "C" to "U" with no air on diaphragm. Flow through heat exchanger from "C" to "L" with air on diaphragm.

TYPE 667-Y

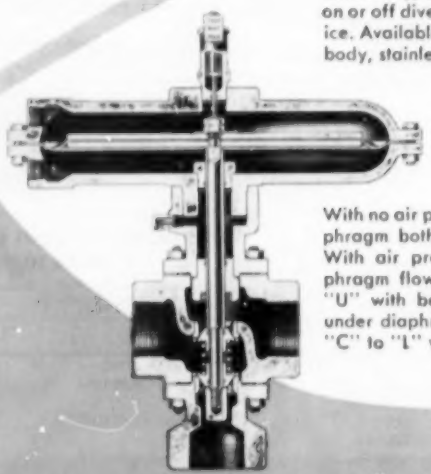
Three-way control valve single disc type for by-pass or mixing applications. Available all castable alloys sizes ½ thru 12".

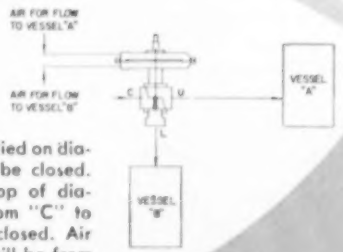


Normal flow is from "U" to "C" with air off diaphragm. With air under diaphragm flow is through exchanger from "L" to "C".

TYPE 1620

Three-way, three-position valve for on or off diversion and shut-off service. Available with 2" screwed steel body, stainless steel trim.





With no air pressure applied on diaphragm both ports will be closed. With air pressure on top of diaphragm flow will be from "C" to "U" with bottom port closed. Air under diaphragm flow will be from "C" to "L" with upper port closed.

FISHER GOVERNOR COMPANY

MARSHALLTOWN, IOWA • WOODSTOCK, ONTARIO

LEADS THE INDUSTRY IN RESEARCH FOR BETTER PRESSURE AND LIQUID LEVEL CONTROL

FISHER Since 1880

William B. Plummer, formerly president of Indoil Chemical Co., has opened offices in New York as a consultant in the petrochemical and related fields. He retired recently after 26 years service with Indoil and Standard Oil Co. (Ind.), the parent company.

O. V. Tracy has been elected a vice-president of Esso Standard Oil Co. He continues as a member of the Esso board and the executive committee.

J. Frank Drake, former president and retired chairman of the board of Gulf Oil Corp., is the 1956 recipient of the American Petroleum Institute's gold metal for distinguished achievement.

Mr. Drake

The award was made for Drake's leadership in the industry. It was presented at the API's annual meeting, in November.

Drake retired in 1955 after having served five years as chairman of the board and 17 years as president. He is still a member of Gulf's board, though, and of its finance committee.

R. D. Rogers, vice-president and executive assistant to the eastern division general manager of Tidewater Oil Co., has retired after 36 years of service.

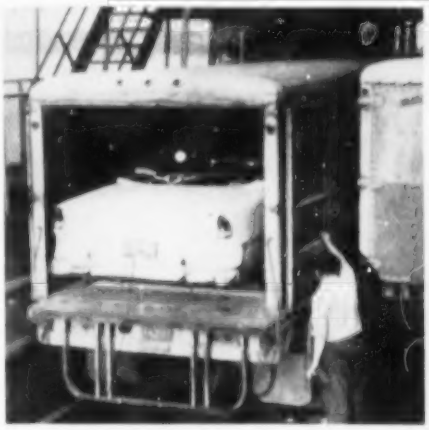
Rogers joined the company in 1920 as chief engineer of refineries and natural gas plants of the subsidiary Tidal Refining Co., Tulsa. He has since been in refining, sales, transportation and supply.

Bruce K. Brown has been elected president and chief executive officer of Petroleum Chemicals, Inc. W. Alton Jones, chairman, and L. F. McCollum, president, have resigned their posts in this jointly owned subsidiary of Cities Service Co. and Continental Oil Co.

James F. Adams and **Dr. C. William Roos,** project leaders in the chemical engineering section of Monsanto Chemical Co.'s research department, have become group leaders. Adams is in charge of engineering and economic evaluations. Roos of engineering research. Both are in the organic chemicals division.

Oilman Plays 'Piggy-Back' on a Boat

AN OILMAN apparently never knows when he's licked. John Lincoln was driving with three friends to a wedding on Long Island. The friends were to be bridesmaids and an usher. Coming from New England, they wanted to jump to the Island via the New London, Conn., ferry—a short cut. But the boat was full, and the next one would be too late. With the help of a truck driver, Lincoln came up with the solution shown here. He is a process engineer at Esso Standard Oil Co.'s Everett, Mass., refinery. And probably a good one.



L. E. Oberhelman, head engineer of the Standard Oil Co. (Ind.) Sugar Creek, Mo., refinery, has been named vice-chairman of the Committee on the Petroleum Industry of American Institute of Electrical Engineers.

T. M. Kerr, formerly executive vice-president of Kerr-McGee Oil Industries, has been elected vice-chairman of the board of directors.

F. C. Love, who was general vice-president, has become executive vice-president.

A. T. F. Seale, vice-president of manufacturing, takes the title of vice-president of operations.

R. M. Chesney has been elected vice-president for refining.

J. W. Roach has been made vice-president of crude oil supply, pipelines, and refinery technical services.

Chesney and Roach were vice-presidents of Deep Rock Oil Co. before its absorption by Kerr-McGee.

F. Cushing Smith has become general manager of the supply and transportation department of Standard Oil Co. (Ind.). Since last March he has been assistant to the president. He is a graduate of Cornell University and joined Standard in 1943 as a chemical engineer at Whiting.

J. A. Kappele, formerly with Humble Oil & Refining Co., has joined his father's firm, Kappele Engineering Co., and will head up the Tulsa office.

Kappele received a mechanical engineering degree from Oklahoma A & M in 1948 and has been with Humble for eight years, working in the maintenance engineering department at the Baytown refinery.

John W. Lane, manager, automotive division, lubricating department of Socony Mobil Oil Co., has been named 1957 president of the National Lubricating Grease Institute.

Thomas Baron has been promoted to the head of the chemical engineering department at Shell Development Co.'s Emeryville research center.

He holds a Ph.D. from the University of Illinois and later left an assistant professorship at that school to join Shell Development. He was made assistant head of the chemical engineering department a year ago.

Two men at Esso Standard Oil Co.'s Bayway refinery have been promoted to technologist, the company's term for a specialist in a phase of refinery operation. Both are in the economics and design division.

Frank Pfaff's specialty is statistical work on operational research problems concerning computers. He holds a B.S. in chemical engineering from Notre Dame University. Since 1952 he has been with economics and design.

Frank Wehrfritz has done statistical analyses of a variety of industrial problems. He holds a bachelor's de-

gree from Syracuse University and a master's from Rutgers. He joined Bayway in 1954 and was in the chemical products lab until this promotion.

Promotions in the Bayway laboratory are as follows:

Jules Rocca, from chemist to head of the experimental group in the petroleum products lab. He has a B.S. in chemistry from Notre Dame.

Art Pavlick, from chemist to head of technicians in the chemical products experimental lab. Pavlick has a B.S. from Wagner College.

Donald Schumacher, from the chemical products lab to group head in the petroleum products lab.

Mr. Soudriette

Mr. Witherspoon

William C. Soudriette has been appointed plant manager of the East Chicago, Ind., refinery of Cities Service Oil Co. He succeeds **L. E. Taylor,** who is to be chief engineer of Petroleum Chemicals, Inc.

John A. Witherspoon has become assistant manager of operations at East Chicago.

Soudriette began with Cities Service in 1947 and worked as a senior engineer and foreman at East Chicago until 1955. Then he transferred to Bartlesville as staff assistant in the refining division. He is a graduate of Rose Polytechnic Institute of Brooklyn and did advanced work there and at Purdue University.

Witherspoon has held the job of plant superintendent since 1947. He joined the company in 1923. He is a graduate of Texas A & M and did advanced work at the Indiana University.

Ralph N. Boyd has left Tidewater Oil Co. to become the administrative assistant to the executives of the Refinery Engineering Co. of Tulsa. With Tidewater, he was manager of the refinery at Drumright, Okla., a job he has held since 1949.

Boyd holds a B.S. in chemistry from Coe College, and in 1918 he received a master's in chemistry from the University of Nebraska. He was associated with Standard Oil Co. (Ind.) from shortly after World War I until 1928, when he joined Tidewater as chief chemist.

Thomas W. Kunkel has succeeded **H. O. Stevenson** as refinery superintendant of the Caminol Co., which has a refinery at Hanford, Calif.

Eight engineers have been promoted to group heads at Esso Research & Engineering Co. The first five are in design engineering:

John Beesley, heading the newly formed process development group in the engineering development section.

Jerry Canevari, heading the materials group of the engineering laboratory section.

Tom Leahey, heading the development group in the mechanical engineering section.

Dick Kilpert, who heads a newly formed project group in the mechanical engineering section.

Robert Thomas, who is head of a new group in the process design section.

The other three men were promoted in the planning engineering division:

Ray Beresford and **Don Hedeen** have both become heads of groups in the refinery economics section.

John Taylor, to group head in the process engineering section.

V. H. Goodwin and **P. L. Lafosse** have been named supervising engineers in the engineering division of Humble Oil & Refining Co.'s Baytown refinery. **H. L. Post** has become senior design engineer in the division.

Goodwin, who holds a B.S. degree from Texas A.&M. College, will be in charge of the group that provides engineering guidance and inspection for the lube extraction and light oil-treating units.

Lafosse, B.S. in civil engineering from Southwestern Louisiana Institute, will supervise the group engaged in design work on various refinery equipment.

Post, who holds a B.S. in electrical engineering from the University of Texas, will work with the operation and maintenance of refinery power plants and electrical substations.

N. Dudley Steele has been made general production superintendent, carbon black department of Cabot Carbon Co.'s southwestern division. He was previously assistant general production superintendent of the department.

James O'Connor Brown has been elected a vice-president of Petro-Tex Chemical Corp. He is plant manager of the Houston butadiene plant, which was purchased from the government in 1955.

Mr. Brown

Brown has been with the Gulf Coast oil industry for over 40 years. He worked with Sinclair Refining Co. for most of this time, and took over management of the butadiene plant when it was constructed at the beginning of World War II, with Sinclair as operating company.

Dr. William A. Pardee has been given the Scroll of Honor of the American Chemical Society's division of industrial and engineering chemistry. He is a chemical engineer in the Gulf Research and Development Co.'s process division, petrochemical section, and was honored for his services to the Society and the division.

Pardee received a doctorate in engineering from Yale University in 1941. His undergraduate work was at Emory University. He joined Gulf in 1941.

Bryson M. Filbert has joined the administrative office of International Petroleum Co. Ltd., Coral Gables, Fla., as manufacturing advisor. He was formerly chemical products coordinator with Humble Oil & Refining Co., Houston.

Filbert holds a B.S. in chemical engineering from Pennsylvania State University, awarded in 1936.

George L. McMahon, president of Pacific Petroleum Ltd., has been appointed to the board of directors of X-L Refineries Ltd. **Dr. Charles L. Heatherington,** Pacific Petroleum's vice-president of production and manufacturing, and **L. M. Youell,** assistant secretary, were also added to the X-L board.

G. A. Stein has been named managing director of Esso Standard Refinery S.A. in Belgium. Stein was for many years with Esso's Baton Rouge refinery.

The REFINERY ENGINEERING Company's horizons are greatly expanded. Treco is now in position to offer engineering, design and construction of refineries, chemical plants, ore processing, secondary recovery and gas processing facilities on a world-wide basis.

The company has greatly enlarged engineering resources, research and development laboratories and a rapidly expanding staff. This enables The REFINERY ENGINEERING Company to offer a *complete service* to nearly all types of industries.

Treco has just produced a brochure which shows the Company's facilities with photographs of completed projects. A copy will be mailed you promptly upon request on your company's letterhead.

A DIVISION of VITRO CORPORATION of AMERICA

The REFINERY ENGINEERING Company

NEW YORK TULSA TORONTO

THESE MIDWEST "LONG TANGENT" ELBOWS SAVED $4121 IN PIPE

MIDWEST "LONG TANGENT" ELBOWS COST NO MORE THAN OTHER ELBOWS

Here are 1227 Midwest "Long Tangent" Elbows (12", 14" and 16" standard weight) ready for shipment to a chemical plant. Each Midwest "Long Tangent" Elbow has a straight section on each end equal in length to ¼ the nominal pipe size. Thus a 12" elbow saves 6" of 12" pipe while a 16" elbow saves 8" of 16" pipe. It doesn't take long to save a lot of pipe and a lot of money . . . in this instance $4121.

But saving pipe is not the only advantage of Midwest "Long Tangent" Elbows. They often eliminate short nipples and their extra welds . . . save time and money in lining up and clamping pipe and fittings . . . slip-on flanges are more easily applied. For all the facts, write for Catalog 54.

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MIDWEST WELDING FITTINGS

MIDWEST WELDING FITTINGS Improve Piping Design and Reduce Costs

7055

Procon Appoints Division Mgr.

James R. Britt has been appointed manager of the chemical plants division of Procon Incorporated. He was formerly with Fabricated Steel Products, Waskom, Texas, and before that with Cities Service Oil Co. as staff executive of the manufacturing department.

Mr. Britt is a chemical engineering graduate of Louisiana State University.

Selas Revamps Research Staff

The staff of research engineers at Selas Corp. of America has been organized in four basic laboratory teams for more efficient operation. The engineers are now grouped under these heads:

1. Applied Research, which sponsors investigations, special combustion process projects, and development of improved combustion equipment.

2. Scientific Research, which carries on mathematical and physical investigations of heat transfer, fluid mechanics, and other theoretical considerations of combustion.

3. Customer Inquiry Research, where specific processes employing advanced combustion techniques are developed.

4. Metallurgy, which conducts general investigations of metal treating processes.

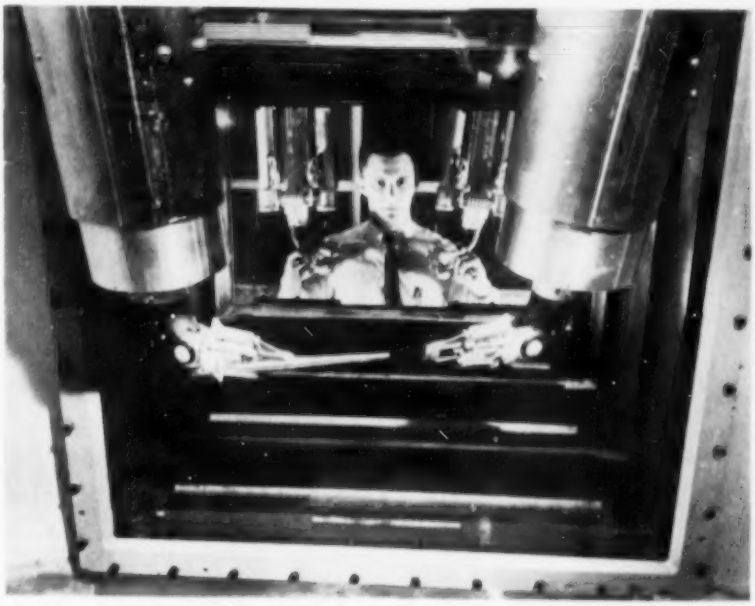
Supporting these permanent teams are a chemical laboratory, ceramics laboratory, a group of lab design engineers, and a recently enlarged pool of laboratory technicians. The research teams are under the direction of A. A. Furczyk, department head.

Ervasti Joins C&H of Canada

E. W. Ervasti has been appointed general sales manager of Calumet & Hecla of Canada Ltd., the new Canadian subsidiary administered by the Wolverine Tube Division of the U. S. firm.

Mr. Ervasti

Ervasti has served in various capacities with Wolverine for 18 years and his last post was as industrial sales manager. He has also been sales representative in both the Detroit and St. Louis areas.



ISOTOPES FOR INDUSTRY are being produced in a new facility of the Budd Co., Philadelphia. Strengths up to 10,000 curies are available. Company also makes accessory equipment for employing the isotopes. Here technician extracts material from a capsule by means of remote controlled tweezers. Window is 3-ft-thick, high density glass.

Graver Names Gen'l Sales Mgr.

Henry J. D'Aragon has been made general sales manager of Graver Tank & Manufacturing Co. He has been manager of eastern sales for the company, and now is head of the national sales of steel and alloy tanks and vessels, both shop-built and site-erected.

Mr. D'Aragon

He will make his headquarters at the East Chicago, Ind., plant. He is an engineering graduate of Cornell University and has been with Graver for 15 years, mostly in New York.

New President of Mason-Neilan

F. Kenneth Morrison has been named president and general manager of the Mason-Neilan Division of Worthington Corp., succeeding Eldon Macleod, who is retiring after 43 years of service.

Morrison began with the Mason Regulator Co. in 1924 as a salesman. He was made general sales manager in 1927 and continued in that job after merger with Neilan Co. in 1931. In 1933 he became vice-president of sales.

Pacific Pumps Picks Sales V-P

A. F. Canada has been elected vice-president in charge of sales of the centrifugal pumps division, Pacific Pumps Inc. He was formerly sales manager of the division.

A graduate engineer of Mississippi State College, Mr. Canada has been active in sales and engineering of centrifugal pumps since 1929. He joined the company in 1945.

Diamond to Boost Houston Output

A 40% increase in daily output of electrolytic products is planned for the Deer Park plant of Diamond Alkali Co., to become effective in the first half of 1958. An additional 200 tons of chlorine, 220 tons of caustic soda, and 2,000,000 cu ft of hydrogen per day will be available to Gulf Coast industry and to other Diamond plants. Deer Park is on the Houston Ship Channel near Houston.

The mercury-type cell method of electrolyzing salt brine will be the basis of the new production facilities.

and the plant will then use both this and the conventional diaphragm cell methods.

Haynes Names Sales Manager

Charles G. Chisholm has been appointed sales manager of Haynes Stellite Co., a division of Union Carbide and Carbon Corp. Mr. Chisholm has been sales development manager for investment castings and for high-temperature and corrosion resistant alloys during the past several years.

Mr. Chisholm

He joined the company after his graduation from Lafayette College in 1933, where he received a B.S. in chemical engineering. His first post was as chemical laboratory assistant and later he worked in various manufacturing departments. In 1936 he joined the general sales department and was assigned the responsibility of developing the sale of corrosion-resistant alloys.

Mr. Blakeslee

Mr. Skiba

Brown Fintube Promotes Four

J. R. Blakeslee has been promoted to vice-president of heat exchanger sales for Brown Fintube Co. He was formerly sales manager.

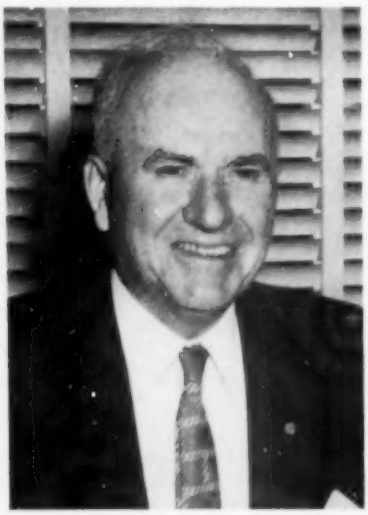
E. J. Skiba, who was chief engineer, has been raised to vice-president of engineering design.

George Clarke, formerly a design engineer, has become assistant chief engineer of gas equipment.

The former assistant chief thermal engineer, Douglas Towers, has been promoted to chief thermal engineer.

Personnel Changes

Calumet & Hecla—Jack H. Smith to director of the copper division, Business Defense Services Administration, Department of Commerce. He is on loan from Wolverine Tube Division, where he is east-central district sales manager.



FIRST UOP DESIGN TEAM had brothers Hugo and Lyman Huff as its nucleus. Now they have completed 35 years with the company and the industry. Educated by night and correspondence schools, they joined Universal Oil Products four days apart in 1921. Today Lyman, left, 68, designs reforming process units, and Hugo, 64, is a specialist in refinery piping specifications

Beckman Instruments, Inc.—H. S. Stover to eastern data and control systems representative of the scientific instruments division. He is based at Mountainside, N. J.

Rockwell Mfg. Co.—Ralph A. Purcelli to general manager of the new plant at Statesboro, Ga. He was formerly assistant general manager of the Norwalk, Ohio, gas regulator plant.

U. S. Stoneware Co.—Howard H. Friedel to sales engineer of the process equipment division. He is a chemical engineering graduate of Case Institute of Technology, Class of 1940, and has worked at Hooker Electrochemicals and Diamond Alkali.

Alloy Steel Products Co.—Harold C. Templeton to chief metallurgist. He was formerly chief metallurgist for the Lebanon Steel Foundry.

Houdry Process Corp.—Dr. Heinz Heinemann has been elected president of the newly organized International Congress on Catalysis. He is section chief in charge of process research at the Linwood laboratories.

Ethyl Corp.—G. O. Hayes, formerly Houston plant manager, has taken the title of resident manager of the plant; M. C. Hudgins, formerly assistant plant manager at Baton Rouge, has become assistant resident manager at Houston; J. J. Bergin, who was on special assignment, has been made assistant resident manager at Baton Rouge; J. C. Clock, previously acting assistant manager, has been appointed manager of maintenance and on-plant construction at Baton Rouge.

Norton Co.—William F. Watts to factory superintendent of the recently formed refractories division. He was previously superintendent of the refractories plant.

Western Supply Co.—Lloyd A. Alaback to sales engineer, handling Brown-Fintube heat transfer equipment in Kansas, Oklahoma and western Missouri.

Fluor Corp. Ltd.—M. A. Ellsworth, vice-president and general manager of the engineering and construction division, has been named to the board of directors.

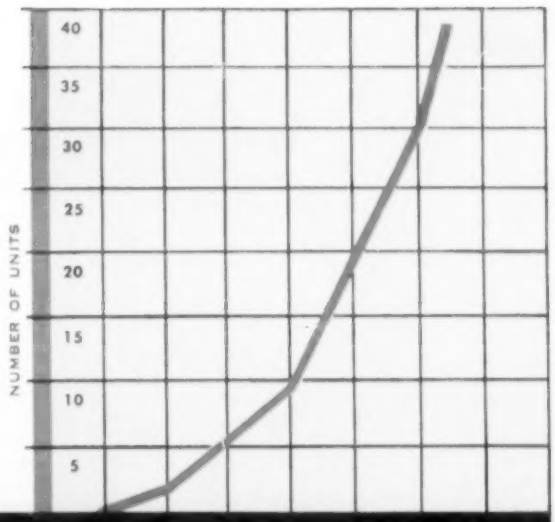
Stone & Webster Engineering Corp.—Donald N. McCord to construction manager. He has been with the company since 1941.

Kaiser Steel Corp.—Harry L. Warner to sales manager of the Fontana fabricating division. He was last manager of contract sales at the Napa fabricating division.

ACCEPTANCE BASED ON PERFORMANCE

In 1951, Petreco installed the first commercial Electrofining unit for distillate treating. Today, there are 37 Electrofining units in operation or under construction in Pennsylvania, California, Kansas, Texas, Indiana, Delaware, Virginia, Louisiana, Ohio, Illinois, Oklahoma, Washington, Nova Scotia, Aruba, N.W.I. and many more on order.

This rapid acceptance was brought about by factual performance. Petreco stated that Electrofining was the most efficient method for contacting light hydrocarbons with treating agents that had ever been developed. On installation after installation Electrofining equipment proved this to be true. In refinery after refinery, less efficient distillate treating procedures were discarded and Electrofining adopted.



REFINERY LOCATION	PETRECO ELECTROFINING TREATMENT	NUMBER OF UNITS	BPD CAPACITY	STOCK TREATED
Pennsylvania	Caustic scrub—Water wash	1	12,500	Gasoline
Pennsylvania	Caustic scrub—Water wash	1	3,600	Gasoline
California	Acid	1	16,000	Light pressure distillate
Kansas	Doctor—Water wash	1	11,000	Straight run and cracked gasoline
California	Lube	4	8,600	Lube and spray oils
Texas	Caustic scrub—Water wash	2	5,000	Thermally cracked distillate
Texas	Caustic scrub—Water wash	2	5,000	Cat distillate
Texas	Caustic scrub—Water wash	2	12,000	Cat distillate
Texas	Caustic scrub—Water wash	1	12,000	Cat distillate
Indiana	Caustic scrub	1	10,000	Blend of light cycle oil-straight run naphtha
Texas	Lube	1	4,430	Lube oils
Texas	Sulfonation	1	2,000	Virgin distillate
Indiana	Acid-alkali	1	2,500	Seal oil, refined, base
California	Acid-alkali	1	3,000	Cat distillate
California	Caustic scrub—Water wash	2	26,000	Straight run gasoline
Delaware	Caustic scrub—Water wash	1	10,000	Heavy cat gasoline
Canada	Caustic scrub—Water wash	1	6,000	Cat cracked gas oil
Canada	Caustic scrub—Water wash	2	9,000	Natural gas oil
Virginia	Caustic scrub—Water wash	1	5,000	Cat cracked gasoline
Louisiana	Caustic scrub—Water wash	1	9,000	Virgin diesel fuel
Ohio	Alkylation acid	1	4,500	Alkylation products
Illinois	Caustic scrub	2	20,000	Cat cracked gas oil
Oklahoma	Acid-alkali	2	6,000	Platformer charge naphtha
Washington	Water wash	1	11,500	Virgin No. 2 Fuel Oil
California	Acid-alkali	1	5,000	Jet fuel
Aruba, N.W.I.	Weak caustic	1	17,000	SO_2 Raffinate
Aruba, N.W.I.	Weak caustic	1	6,000	SO_2 Extract

The graph above shows how rapidly Electrofining has been accepted by refiners. The table at the left shows not only the wide acceptance, but also the large volumes of differing petroleum stocks treated.

If you acid-treat, caustic-scrub, doctor-treat, water-wash, Sulfonate, remove arsenic, metal poisons and nitrogen bases, or otherwise treat hydrocarbon streams, Electrofining will help you do it better. Compared with conventional contacting or washing methods, Electrofining requires less equipment, less ground space and less operating attention. It costs less to install, can be purchased or rented, and is *serviced by Petreco.* Treatment is fast, effective, reliable and continuous. Electrofining processing is designed to deliver treated products which will meet *your* specifications such as sodium ion content, stability, tarry acid content, arsenic content, sweetness, water tolerance, etc.

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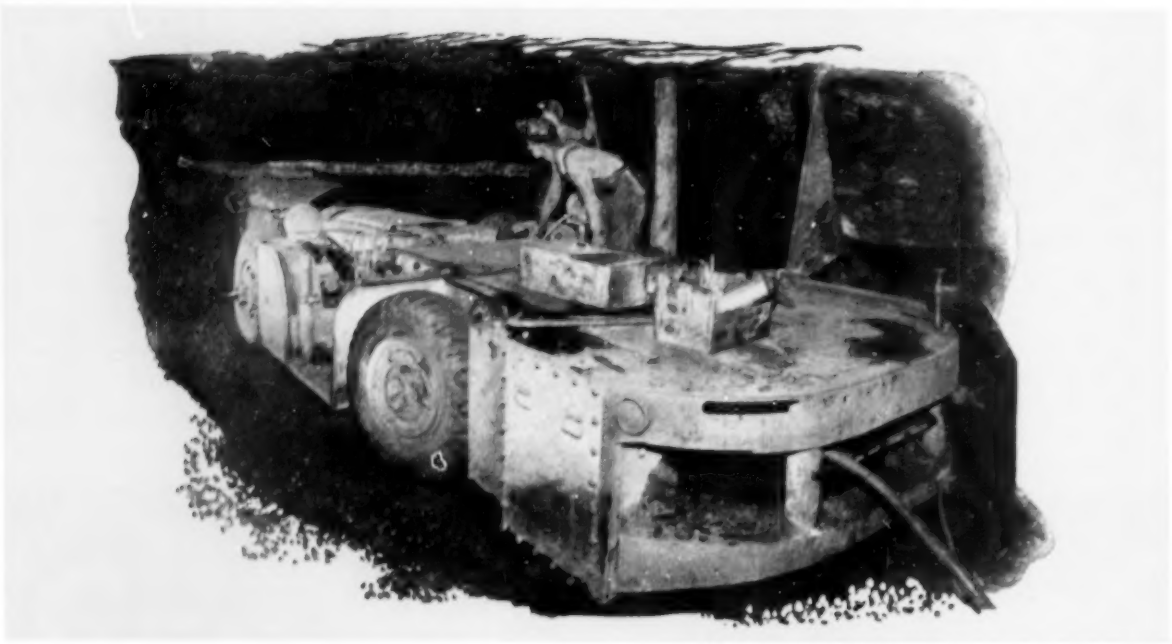
 (To obtain more data on advertised products see page 114)



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Estersil GT offers many advantages to grease users and compounders

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4. Superior oxidation stability—Estersil greases are almost as stable as their base oils and need no antioxidants under most service conditions.

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6. Easy to make—A milling operation is all that is required to manufacture estersil greases.

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 (To obtain more data on advertised products see page 114)

Cobalt Titanate Catalyst Saves Octanes

. . . when hydrodesulfurizing olefin streams

THE EVER increasing importance of catalytic hydrodesulfurization in refinery processing has led to development of many catalysts. The most commonly used catalyst for desulfurization is the cobalt molybdate-alumina catalyst first introduced by Union Oil Co. of Calif.

One big drawback of these otherwise rugged, cheap and effective cobalt molybdate catalysts—as well as the others in commercial use—is that they will hydrogenate olefins while desulfurizing olefinic naphthas.

Olefinic naphthas (coke still, thermal, etc.) may lose 10-20 octane numbers during catalytic hydrodesulfurization. Olefin saturation is the cause of this octane loss.

A new catalyst composition that can be used for the selective desulfurization of olefinic hydrocarbon oils has been described by Standard Oil Co. (Ind.) in U. S. Patent 2,764,526.

Cobalt titanate is the active ingredient in Standard of Indiana's selective hydrodesulfurization catalyst, with the formula $Co(TiCo)O_4$, and of the inverse spinel type. It may be used alone, or as an essential component of an inert carrier.

Though the new catalyst does not completely eliminate saturation of an olefin stream being desulfurized, it does control the reaction enough so that the substantially desulfurized process effluent's octane number (with 3 cc of TEL) is higher than the initial octane before processing.

Typical results for the hydrodesulfurization of a coke still naphtha (obtained from the delayed coking of a mixture of high sulfur reduced crude, primarily from West Texas origin) is shown in Table 1. This feed had a sulfur content of 0.545% and a bromine number of 70. The feed was passed over cobalt titanate catalyst along with 2000 SCF of hydrogen per barrel of feed.

High selectivity for desulfurization (over hydrogenation) is seen when studying Table 1. Note that the conditions of Runs 2 & 3 were best. Although the catalyst was contacted with 49 volumes of coke still naphtha per volume of catalyst, there was no sign of activity loss.

A comparison to a typical commercial hydrodesulfurization catalyst, a cobalt oxide-molybdenum oxide on alumina type (3% CoO, 9% MoO_3), in Table 2 shows the superiority of the cobalt titanate catalyst in desulfurizing an olefinic stream, resulting in a high leaded octane number.

Table 1—Hydrodesulfurization of Coke-Still Naphtha with Cobalt Titanate Catalyst

Run No.	Temp., °F	Pressure, psig	Space Vel., v/hr/v	Desulf., %	Paraffination, %	Selectivity*
1	750	1000	2.0	81	52.3	1.5
				81	50.0	1.6
				82	54.2	1.5
				83	56.4	1.5
2	750	500	2.0	88	48.6	1.8
				86	47.9	1.8
				87	49.3	1.8
				87	54.2	1.6
3	750	500	3.0	84	42.0	2.0
				80	42.2	1.9
				82	44.3	1.8
				80	47.1	1.7
4	750	500	1.0	92	70.6	1.3
				93	72.2	1.3
				92	71.4	1.3
5	700	500	2.0	79	49.3	1.6
				72	41.4	1.7
6	650	500	2.0	56	28.6	2.0
				56	27.9	2.0

*Selectivity = % desulfurization/% paraffination.

Table 2—Comparison of Cobalt Titanate with Cobalt-Molybdenum Catalyst

(Octane ratings of hydrodesulfurized coke still naphtha)

Run No.	Catalyst	Desulf., %	Octane Ratings, CFRR Clear	1cc TEL	3cc TEL
Feed	none	—	61.7	67.2	72.2
3*	cobalt titanate	80	56.4	66.2	75.6
7	commercial Co-Mo type	79	52.8	61.8	70.7

*See Table 1 for more on this run with cobalt titanate catalyst.

PATENT BRIEFS

Isomerizing Hydrocarbons—containing at least four carbon atoms in presence of aluminum halide catalyst and a hydrogen halide promoter, and using caustic to neutralize aluminum and hydrogen halides in the effluent. Phillips Petroleum Co., U. S. Patent No. 2,764,624.

Platinum Catalyst Regeneration—removing carbon deposits by hydrogenation in the liquid phase (using oil with low polymer-coke forming tendencies) at pressures of 1000-10,000 psig, temperatures of 600-900°F, 5-30% powdered catalyst in the oil slurry, and 1000-2000 CFH_2/bbl oil. Esso Research & Engrg. Co., U. S. Patent No. 2,764,528.

Hydrogen Cyanide Production—by non-catalytic reaction of gaseous O_2, NH_3, and natural gas (or nonaromatic hydrocarbon boiling below 600°F); with temperatures of 2000-3000°F, pressures of 5-50 psia, and C/O ratio of 0.3-1.0 and C/N ratio of 1.0-8.0 in the feed. Union Oil Co. of California, U. S. Patent No. 2,763,532.

(Continued on p. 100)

Reforming Without Recycle H_2—by two-step process wherein aromatization of naphthenes is performed first in a mild reaction using a platinum-alumina catalyst at 600-900°F, 500-1000 psi, and 2-20 weight hourly space velocity; dividing the effluent into several parallel streams and mixing the streams with hydrogen from aromatization, then using a platinum-alumina-halogen catalyst to further reform the streams of 650-1000°F, 400-1000 psi, 0.2-5 weight hourly space velocity, and 2-10 mol ratio of H_2 to hydrocarbon. Universal Oil Products Co., U. S. Patent No. 2,765,264.

Ethylene Oxide Manufacture—by partial oxidation of ethylene with gaseous oxygen in presence of silver containing catalysts with reaction of 150-400°C, 140 psig, and reactant mixture with 4% ethylene and 6-8% oxygen diluted with inert gas; using plurality of sub-reaction zones to prevent hot spots and total combustion of ethylene to CO_2 and H_2. Chempatents, Inc., U. S. Patent No. 2,764,598.

About the Patents Listed

The following patents have been selected because of their interest to the petroleum processing industries. Included in this issue are patents from the Official Gazette of the U.S. Patent Office for Sept. 18, 25, Vol. 710, No. 3, 4, and Oct. 2, 9, Vol. 711, No. 1, 2, 1956.

PROCESSES AND METHODS

FOR . . .	OF . . .	WITH . . .	ASSIGNEE . . .	PATENT . . .
Adsorption	nitrogen bases	solid inorganic oxide adsorbent	Union Oil Co. of Calif.	2,763,603
Analyzing	sulphuric acid	ultra-violet light spectrophotometer	Esso Research & Engrg. Co.	2,765,218
Breaking	water-oil emulsions	acidic demulsifying agent	Petrolite Corp.	2,766,213
Catalytic cracking	hydrocarbons	moving granular catalyst	Socony Mobil Oil Co., Inc.	2,766,186
Catalytic reforming	hydrocarbons	fluidized cat. & plurality of zones	Standard Oil Co. (Ind.)	2,766,185
	hydrocarbons	moving-bed catalyst	Socony Mobil Oil Co., Inc.	2,763,598
	naphthas	elimination of recycle hydrogen	Universal Oil Products Co.	2,765,264
	naphthas	fluidized-bed catalyst system	Esso Research & Engrg. Co.	2,763,595-7 & 2,765,260-1, 3
	naphthas	fluidized platinum-alumina cat.	Esso Research & Engrg. Co.	2,765,262
Chlorination	olefins	liq. alkylene dichloride medium	Ethyl Corp.	2,765,353
Control	gas-solid reaction	magnetic control system	Esso Research & Engrg. Co.	2,765,330
Conversion	cracked gas oil	dilute HNO_3 oxid. & esterif.	Sun Oil Co.	2,766,272
	hydrocarbons	finely divided, moving contact matl.	Sun Oil Co.	2,766,188-9
	RSH to disulfides	solvent phase treating	Shell Development Co.	2,763,594
Conveyance	fluidized solids	conduit having internal spiral rib	Phillips Petroleum Co.	2,763,516
Coking & cracking	heavy residual oils	catalytically inert fluidized-bed	Esso Research & Engrg. Co.	2,763,600-1
Dehalogenation	halophenol	water-ammonia, & primary amine	Universal Oil Products Co.	2,766,295
Desulfurization	Oxo feeds	polym. of butadiene & styrene	Esso Research & Engrg. Co.	2,765,357
Distillation	oil shale	fluidized inert solids mass	Esso Research & Engrg. Co.	2,764,531
Filling	closed container	volitale liquid	Shell Development Co.	2,764,873
Fractionation	liquid mixtures	selective solid adsorption system	Phillips Petroleum Co.	2,764,620
Heat treatment	iso-olefin polymers	anti-sticking agents on heated surfaces	Esso Research & Engrg. Co.	2,766,224
Hydrocracking	asphaltic feed	thermal cracking and gaso. prod.	Gulf Research & Development Co.	2,766,177
	polycyclic aromatics	cat. of siliceus crack. base and Ni comp.	Houdry Process Corp.	2,766,306
Hydrodesulfurization	petroleum fraction	cobalt titanate catalyst	Standard Oil Co. (Ind.)	2,764,526
Hydrofining	naphthas	hydrogenation of heating oil cut	Esso Research & Engrg. Co.	2,763,358
Hydrolysis	ethyl sulfates	control of hydrolysis temperature	Esso Research & Engrg. Co.	2,765,347
Isomerization	alkanes	platinum, acidic base catalyst	Sinclair Refining Co.	2,766,302
	normal paraffins	aluminum halide catalyst	Phillips Petroleum Co.	2,764,624
Manufacture	acetylene	reaction of O_2 with hydrocarbon gas	Hydrocarbon Research, Inc.	2,765,358-9
	alk. earth metal salts	alkyl phenol sulfide-alk. earth metal reaction	Esso Research & Engrg. Co.	2,766,291
	aromatics	oxidative cracking of paraffin gases	Universal Oil Products Co.	2,766,308
	aromatic compounds	aromatic hydrocarbon-copper oxide reaction	California Research Corp.	2,766,294
	aromatic tar	thermal cracking of cat. cycle oil	Esso Research & Engrg. Co.	2,764,527
	benzene hexachloride	actinic light irradiation of Cl_2 & C_6H_6	Columbia-Southern Chemical Corp.	2,765,272
	catalyst	silica-alumina base & platinum	Universal Oil Products Co.	2,763,623
	CO & H_2	oxidation of gaseous hydrocarbons	Esso Research & Engrg. Co.	2,765,222
	cracking catalyst	kaolin and silica hydrogel	Socony Mobil Oil Co., Inc.	2,763,622
	dry granular urea	elimination of evaporative drying	Phillips Petroleum Co.	2,766,107
	elastomers	H_2O emulsification & plasticization	Phillips Petroleum Co.	2,763,635
	ethylene oxide	partial oxidation of ethylene	Chempatents, Inc.	2,764,598&2,766,261
	gasoline	hydrorefin., alk. wash & cat reform.	Universal Oil Products Co.	2,766,179
	hydrogen cyanide	reaction of hydrocarbon, O_2 & NH_3	Union Oil Co. of Calif.	2,763,532
	indene	hydrogen treatment of indane	Esso Research & Engrg. Co.	2,763,701
	light oil	acetylenic-containing gases	Chemische Werke Hulls AG	2,764,524
	methyl acetylene	steam-isobutylene reaction	J. Happel & C. J. Marsel	2,763,703
	mixed ethylxylenes	alkylation of xylene using HF & BF_3	Standard Oil Co. (Ind.)	2,766,307

(Continued on p. 102)

EMPLOYMENT OPPORTUNITIES

The Advertisements in this section include all employment opportunities—executive, management, technical, selling, office, skilled, manual, etc.

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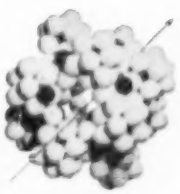

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FOR . . .	OF . . .	WITH . . .	ASSIGNEE . . .	PATENT . . .
	N_2, H_2 & acetylene	partial oxidation of hydrocarbon gas	Texaco Development Corp.	2,764,554-5
	N-ter-alkylarylamine	tert. alkanol-prim. arylamine react.	Universal Oil Products Co.	2,766,277
	odorless solvent	silica gel adsorption system	American Oil Co.	2,764,621
	petroleum resins	petroleum isoprene & olefin	Esso Research & Engrg. Co.	2,764,577
	pitch	dist. of petroleum residues	Godfrey L. Cabot, Inc.	2,763,602
	silica-zirconia cat.	hydrous silica gel & hydrous zirconia	Standard Oil Co. (Ind.)	2,764,558
	sulfur dioxide	metal oxide catalyst	Esso Research & Engrg. Co.	2,766,102
	tetraethyl lead	conversion of hexaethyl dilead	E. I. duPont deNemours & Co.	2,763,673
	tetraethyl lead	ethylation of sodium-lead alloy	Ethyl Corp.	2,765,328
Operation	alkylation unit	acid stripping tower	Phillips Petroleum Co.	2,764,623
	jet aircraft engine	lead-containing hydrocarbon fuel	Esso Research & Engrg. Co.	2,764,866
Polymer	vinylidine	alkyl alcohol plasticizor	Sun Oil Co.	2,766,217
Polymerization	ethylene	cat. of org. lead-peroxide & substituted CH_4	The Borden Co.	2,765,297
	olefins	finely divided metal oxide cat.	Esso Research & Engrg. Co.	2,766,312
	olefins	phosphoric acid catalyst	Esso Research & Engrg. Co.	2,766,311
Pulverizing	solid material	heating solid-liquid slurry	The Texas Co.	2,763,434
Reactivation	metal-poisoned cat.	chromia, steam treatment	Socony Mobil Oil Co., Inc.	2,764,557
Recovery	alkyl phenols	acid, of alk. ext. of cracked petrol. dist.	Shell Development Co.	2,764,618
	cyclohexane	azeotropic distillation	Esso Research & Engrg. Co.	2,766,303
	durene	chilling, crystallization, filtering	Esso Research & Engrg. Co.	2,766,310
	hydrocarbon vapors	absorption system	California Research Corp.	2,765,872
	paraxylene	crystallization process	Esso Research & Engrg. Co.	2,766,309
	sulfur	oxidation of hydrogen sulfide	Texas Gulf Sulphur Co.	2,765,217
Refining	crude oil	comb. fractionation-cracking syst.	Esso Research & Engrg. Co.	2,766,184
Removal	vanadium & sodium	alumina-ferric oxide & H_2	British Petroleum Co. Ltd.	2,764,525
	V & Na metals	fuller's earth on crude petroleum	British Petroleum Co. Ltd.	2,766,183
Regeneration	adsorbent	burning zone following hydration	Socony Mobil Oil Co., Inc.	2,765,282
	Pt-alumina cat.	hydrogenation in naphthenic oil	Esso Research & Engrg. Co.	2,764,528
Separation	aromatic mixture	production of xylene & ethylxylene	Standard Oil Co. (Ind.)	2,766,305
	elemental sulfur	act. carbon adsorp. from hydrocarbon	Esso Research & Engrg. Co.	2,765,914
	ethylene from gas	partial liq., dist. & extraction	Gulf Oil Corp.	2,765,635
	fluid feed mix	series of solid adsorbent beds	Union Oil Co. of Calif.	2,764,252
	hydrocarbons	distillation and solvent extraction	Union Oil Co. of Calif.	2,765,356
	nitrogen bases	organic base exchange resin treat.	Universal Oil Products Co.	2,766,178
	oil feeds	selective solvent extraction system	Phillips Petroleum Co.	2,764,522
	oil and gas	pressure reduction in tank system	National Tank Co.	2,765,045
	organic materials	solvent extraction	Phillips Petroleum Co.	2,766,300
	para-xylene	extractive distillation	Union Oil Co. of Calif.	2,763,604
	urea or thiourea	solid adduct	Phillips Petroleum Co.	2,763,637
Sulfonation	mineral lube oil	concentrated sulfuric acid	Shell Development Co.	2,766,275
Sweetening	cracked naphtha	phenylene-diamine followed by alkali	Standard Oil Co. (Ind.)	2,766,181
	gasoline	hypochloride & caustic oil treat.	Shell Development Co.	2,766,182
	hydrocarbon	alkanol amine, Na-plumbite S & air	Standard Oil Co. (Ind.)	2,766,180
Thermal conv.	hydrocarbon gases	cracking, dehydrog. & polym.	The Pure Oil Co.	2,764,622
Treatment	liquid hydrocarbon	moving columnar mass of adsorbent	Socony Mobil Oil Co., Inc.	2,766,191
	lube oil	phosphorous sulfide & inert gas	Standard Oil Co. (Ind.)	2,766,206

PRODUCTS

Antifreeze	polyhydroxy alc.	insoluble oil phase inhibitor	The Texas Co.	2,765,278
Asphalt	petroleum material	aliphatic aldehyde & ketone reaction	Esso Research & Engrg. Co.	2,764,523
Burning oil	hydrocarbon	anti-wicking additive	Shell Development Co.	2,765,221
Cutting oil	phenol lube extract	sulfonate, glycol, water & caustic	The Pure Oil Co.	2,764,549
Diesel fuel	hydrocarbon base	oil-soluble aliphatic polyether	California Research Corp.	2,763,537
Grease	oleaginous lube	inorganic gelling agent	Pure Oil Co.	2,766,205
	oleaginous lube	modified clay thickener	The Pure Oil Co.	2,766,209
Insecticide	powdered base	organic liquid to make paste	Shell Development Co.	2,765,255
Lubricant	lube oil	carboxylic acid derivative	Monsanto Chemical Co.	2,763,615
	lube oil	corrosion resistant additives	Standard Oil Co. (Ind.)	2,764,547
	lube oil	detergent properties	Esso Research & Engrg. Co.	2,765,277
	lube oil	extreme-pressure-property additive	Shell Development Co.	2,765,276
	lube oil	knock and wear inhibitors	Shell Development Co.	2,763,613 & 617
	lube oil	oxidation inhibitor	Esso Research & Engrg. Co.	2,766,207
	mineral lube oil	oil soluble esterification product	Esso Research & Engrg. Co.	2,764,551
	mineral lube oil	sulfurized-phosphorized fatty body	The Pure Oil Co.	2,764,550
	mineral oil	corrosion-inhibitor	Gulf Oil Corp.	2,763,614
	mineral oil	oxidation inhibitor	Tidewater Oil Co.	2,766,208
Motor fuel	stable gasoline	anti-detonating & scavenging additives	Shell Development Co.	2,765,220
Oxidation agent	low freezing point	HNO_3, $NaNO_2$ and H_2O	California Research Corp.	2,763,619

(Continued on p. 103)

FOR . . .	OF . . .	WITH . . .	ASSIGNEE . . .	PATENT . . .
Polymer	epoxide	copolymer of mono-epoxide & olefin	Columbia-Southern Chemical Corp.	2,765,296
Resin	ester plasticizer	resinous base material	Shell Development Co.	2,764,497
	terpolymer	butene-1, acrylonitrile & SO_2	Phillips Petroleum Co.	2,765,295
Rust-proof mat'l	oxidized asphalt	N-primary amines & tall oil	Esso Research & Engrg. Co.	2,764,495

EQUIPMENT

FOR . . .	OF . . .	WITH . . .	ASSIGNEE . . .	PATENT . . .
Analyzing	gas mixture	selective adsorbent system	Phillips Petroleum Co.	2,765,409
Charging	feedstock	spray nozzle in moving bed reactor	Socony Mobil Oil Co., Inc.	2,766,073
Cleaning	internal threads	plug having radial spray openings	Sun Oil Co.	2,764,991
Closure	pressure vessels	plates and special framework	Combustion Engineering, Inc.	2,765,098
Contacting	fluids	high state of turbulence	Shell Development Co.	2,763,699
	solids-liquids	agitated chamber	Lummus Co.	2,763,515
Control	alkalinity	impedance operated control	Sun Oil Co.	2,765,219
	fluid flow	safety shut-off valve	Phillips Petroleum Co.	2,765,801
Conversion	hydrocarbons	moving granular catalyst	Socony Mobil Oil Co., Inc.	2,766,187
Crystallization	solid-liquid phases	multi-stage pulsating press. appar.	Phillips Petroleum Co.	2,764,878
Dehydration	fluid streams	desiccant packed vessel	A. S. Parks	2,765,868
Detection	radiation	phosphor elements & photo-electric device	Texaco Development Corp.	2,765,411
Determination	fluid level	penetrative radiation	The Texas Co.	2,765,410
Elevation	granular material	pneumatic lift passage	Socony Mobil Oil Co., Inc.	2,765,265
Flow control	fluidized solids	aeration gas-cat. removal column	Esso Research & Engrg. Co.	2,763,599
Heat exchange	fluids	elognated rod-like extended surfaces	A/B Svenska Maskinverkin	2,765,152
	fluids	plurality of exchange units	Olin Mathieson Chemical Corp.	2,766,019
Inside cutting	exchanger tubes	air-motor operated tool	Airetool Mfg. Co.	2,764,812
Multiplication	electrical voltages	deflecting electron beam	Socony Mobil Oil Co., Inc.	2,765,117
Reaction	chemicals	plurality of agitated reactors	Frick Co., Inc.	2,764,476
Reclaiming	oil	heated chamber	W. C. Schwalge	2,765,259
Recovery	vapors	tank filling dome	Superior Tank & Const. Co.	2,763,419
Separation	entrained liq.	centrifugal separating passages	J. A. Campbell	2,765,870
	liquids	solid adsorbent material beds	Phillips Petroleum Co.	2,764,653
Unloading	reactor catalyst	screw-feed conveyor apparatus	Sun Oil Co.	2,765,002
Weighing	heater pebbles	attached conduit apparatus	Phillips Petroleum Co.	2,766,104

LEGAL NOTICE

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code Section 233) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION

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By John J. Cooke, Secretary

Sworn to and subscribed before me this 14th day of September, 1956.

[SEAL] JANET A. HARTWICK
(My Commission expires March 30, 1957.)

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Diesel Fuels Session at SAE Annual

A SESSION on "Economy Fuels for Railroad Diesel Engines" will highlight the oil industry's part of the annual meeting of the Society of Automotive Engineers. The event will be held at the Sheraton-Cadillac and Statler Hotels in Detroit from January 14 to 18.

The fuels symposium will have R. W. Goodale as chairman and P. L. Pinotti as secretary. Both are with Standard Oil Co. of California. Papers to be offered in the session are:

"Heavy Fuels in Railroad Diesels," by W. F. Collins and K. Relyea, New York Central Railroad, and B. W. Geddes and N. H. Rickles, Esso Research and Engineering Co.

"Are Light Residual Fuels Economy Locomotive Diesel Fuels?" by P. V. Garin, Southern Pacific Railroad, and J. L. Broughten, Union Oil Co. of California.

"Trends in Residual Fuels," by R. W. Van Sant, Jr., and A. S. Orr, Gulf Oil Corp.

"Laboratory Full-Scale Engine Testing of Railway-Type Fuels," by J. D. Carmichael, J. V. Kalb and Peter Kalil, The Texas Co.

"Microscopy in the Examination of Diesel Fuels," by F. G. Rowe and H. F. Nicolaysen, Continental Oil Co.

"Bi-Fuel Approach to Burning Residual Fuels in Diesel Engines," by W. C. Arnold and R. H. Beadle, Fairbanks, Morse and Co., and R. L. Logelin and H. D. Young, Sinclair Research Laboratories.

Another session involving the oil industry will be chaired by Leonard Raymond, Socony-Mobil Oil Co. J. B. Duckworth, Standard Oil Co. (Ind.), will act as secretary. Papers to be read in this session are these:

"Spark-Plug Fouling: a Survey—Test Procedures, Fuel Factors," by C. A. Hall, R. C. Beaubier and E. C. Marckwardt, Ethyl Corp.

"Combustion Chamber Geometry and Fuel Utilization," by J. C. Hughes, Continental Oil Co.

"Use of Temperature-Density for Measuring Antiknock Quality," by B. R. Siegel, Sinclair Research Laboratories.

In the final session sponsored by the Fuels and Lubricant Activity chairman will be C. J. Livingstone, Gulf Oil Corp., and secretary, J. R. Landis, General Motors Corp. Papers are as follows:

"Why Does Your Car Wear Out?" by H. R. Jackson, Atlantic Refining Co.

"A Laboratory Study of Automotive Bearings," by G. F. Bonner, Ford Motor Co.

"Valve Train Wear as Affected by Metallurgy, Driving Conditions and Lubricants (Report of CLR-ELD Camshaft and Valve Tappet Wear and Corrosion Group of the Coordinating Research Council)," by Vincent Ayres, Eaton Manufacturing Co., J. B. Bidwell, General Motors, A. C. Pilger, Jr., Tidewater Oil Co., and R. K. Williams, Lubrizol Corp.

South-wide Conference Planned by ACS, Dec. 6-8

The traditional southwest and southeast meetings of the American Chemical Society will be combined this year in a South-wide Chemical Conference at Memphis, Tenn., Dec. 6-8.

The conference will include sessions on chemical engineering, nuclear engineering, organic chemistry, petroleum chemistry, instrumentation, and other phases of the chemical industry. Some of the papers in the instrumentation sessions are as follows:

"Some Uses of Gas Chromatography in Petroleum Process Research," by H. M. Penney and F. A. and J. W. McQuaid, Esso Research and Engineering Co.

"Sampling Systems for Plant Stream Analyzers," by D. C. Field, Esso Standard Oil Co.

"Should Process Instrumentation and Automation Be Wed?" by D. W. Thomas, Texas Butadiene and Chemical Corp.

In the sessions on petroleum chemistry these will be among the papers read:

"Commercial Application of Dual-ayer Gasoline Process," by C. A. Duval, R. M. Huff, B. C. Phenix, Magnolia Petroleum Co.

"Effects of Certain Additives on Formation of Carbon Particles from Hydrocarbons," by J. D. Frazee, R. C. Anderson, University of Texas.

"Radiotracer Studies of Engine Deposit Formation," C. N. Sechrist, H. H. Hammen, American Oil Co.

"Free Radical Alkylation with

Oil Man's Calendar

(Boldface items reviewed in this issue)

DECEMBER

3 Synthetic Organic Chemical Manufacturers Assn., annual, Biltmore, New York City

6-8 South-wide Chemical Conference, American Chemical Society, Memphis

9-12 American Institute of Chemical Engineers, annual, Statler, Boston

JANUARY

14-18 Society of Automotive Engineers, annual, Sheraton-Cadillac and Statler Hotels, Detroit

17-18 Engineers Joint Council, Statler Hotel, New York City

21-25 American Institute of Electrical Engineers, winter general, New York

23-25 Instrumentation for the Process Industries, symposium sponsored by Texas A. & M., College Station

28-30 8th Plant Maintenance and Engineering Conference, Statler, Cleveland

FEBRUARY

4-8 American Society for Testing Materials, committee week, Franklin Hotel, Cleveland

8-9 Symposium on Composition of Petroleum Oils, Research Division IV on Hydrocarbon Analysis, ASTM, Jung Hotel, New Orleans

22 Natural Gasoline Assn. of America, Permian Basin regional, Scharbauer Hotel, Midland, Texas

MARCH

3-6 American Institute of Chemical Engineers, national, White Sulphur Springs, West Virginia

10-16 Nuclear Engineering and Science Congress, ASME and others, Philadelphia

11-15 National Assn. of Corrosion Engineers, annual, Kiel Auditorium, St. Louis, Mo.

18-21 Gas Turbine Power Conference, ASME, Sheraton-Cadillac, Detroit

25-27 Western Petroleum Refiners Assn., annual, San Antonio

27-28 Engineering Management Conference, ASME, Penn Hotel, Pittsburgh

APRIL

7-12 American Chemical Society, national, Miami

8-10 American Society of Mechanical Engineers, spring meeting, Dinkler-Tutwiler, Birmingham, Ala.

15-17 American Society of Lubrication Engineers, annual meeting, Sheraton-Cadillac Hotel, Detroit, Michigan

16-18 National Petroleum Assn., semi-annual, Hotel Cleveland, Cleveland

24-26 Natural Gasoline Assn. of America, annual, Rice Hotel, Houston

MAY

13-16 American Petroleum Institute, Division of Refining mid-year meeting, Penn-Sheraton Hotel, Philadelphia

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Ethylene—Part 1: Effect of Reaction Conditions," by J. A. Ridgeway, American Oil Co.

"Determination of Trace Amounts of Combined and Elemental Sulfur in Petroleum Fractions," by N. W. Houghton, American Oil Co.

AIChE Annual to Discuss Chemical Plant Automation

A round-table discussion, "Advancing the Automatic Control of Chemical Process Plants," will be an important feature of the annual meeting of the American Institute of Chemical Engineers this year. The event is to be held at the Hotel Statler, Boston, December 9-12.

The discussion will be co-chaired by Wayne D. Alexander, Monsanto Chemical Co., and Dave M. Boyd, Universal Oil Products Co. Members will be P. S. Buckley, Du Pont Co.; John Draffen, Monsanto; E. G. Holzmann, Shell Development Co.; A. R. Aikman, Schlumberger Well Surveying Co.; and Fred Woods, Carbide & Carbon Chemicals Co.

A three-part symposium on "The Sales Engineer in Chemical Engineering" will be part of the meeting, as well as a symposium on "The Role of the Chemical Engineer in the Industrial Environment." In the latter event, the following papers will be read:

"The Responsibility of the Chemical Engineer in Industry," by J. McAfee, Gulf Oil Corp.

"What Makes a Competent Chemical Engineer?" by C. M. Cooper, Du Pont Co.

"From New Ideas to New Profits —the Role of the Chemical Engineer in the Creative Process," by H. C. Silcox, Merck & Co.

"Future Fields for the Chemical Engineer," by W. T. Nichols, Arthur D. Little, Inc.

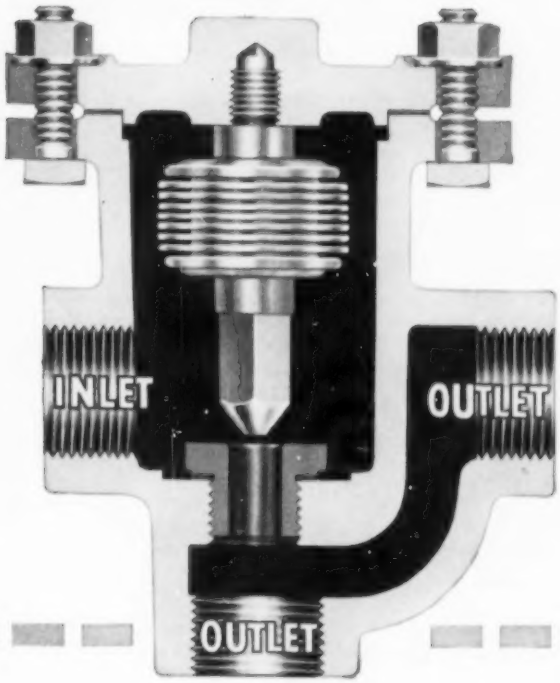
Among the general papers, at least these four should be of interest to the petroleum refiner:

"Design of Perforated Plate Fractionating Towers," by G. A. Hughmark and H. E. O'Connell, Ethyl Corp.

"Ripple Trays—a New Tool for Vapor-Liquid Contacting," by M. H. Hutchinson and R. F. Baddour, Stone & Webster Engineering Corp.

"A Rigorous Graphical Method for Calculating Multicomponent Distillations," by R. J. Hengstebeck and D. W. Schubert, Standard Oil Co. (Ind.).

FITS TO A "T"



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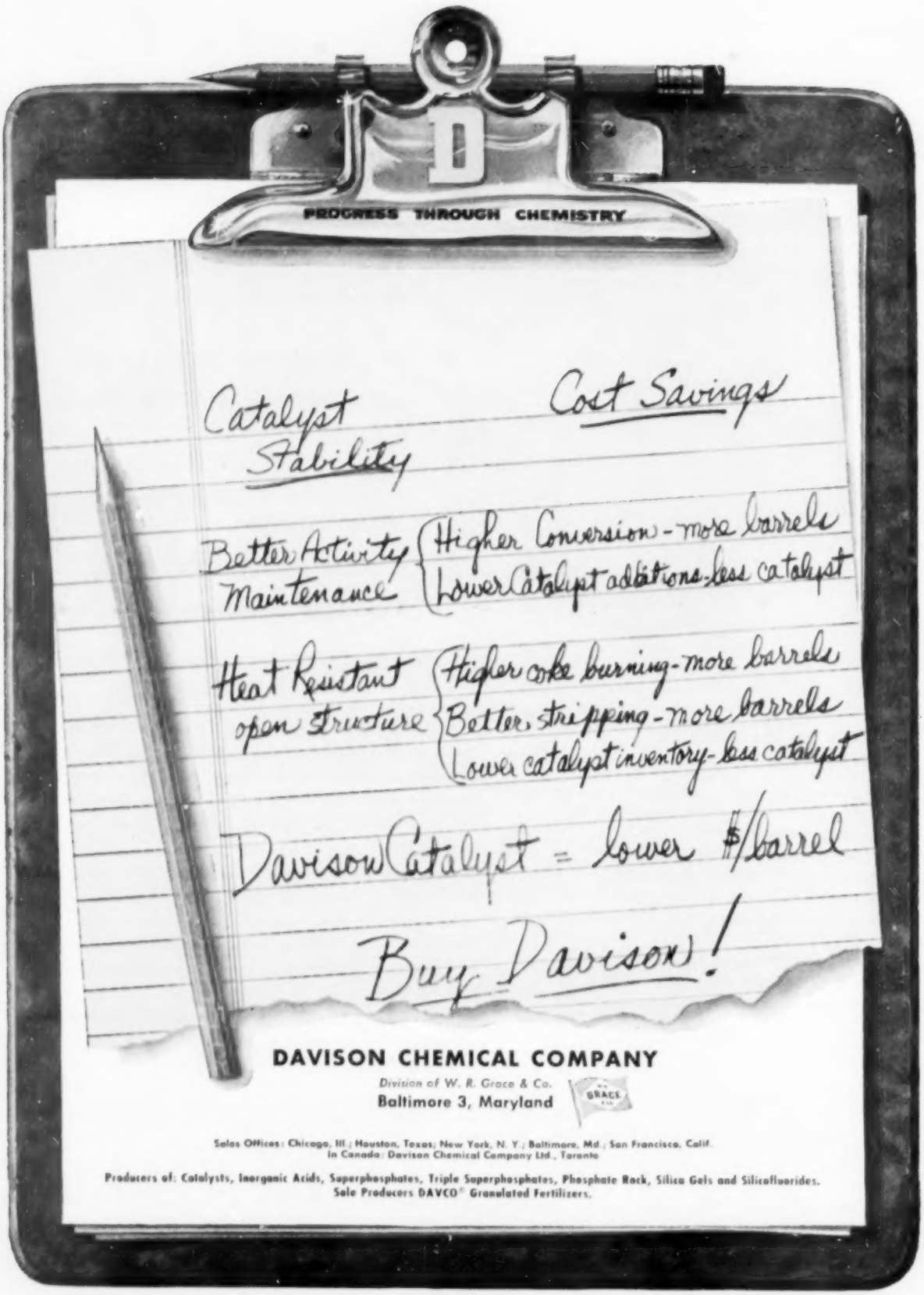
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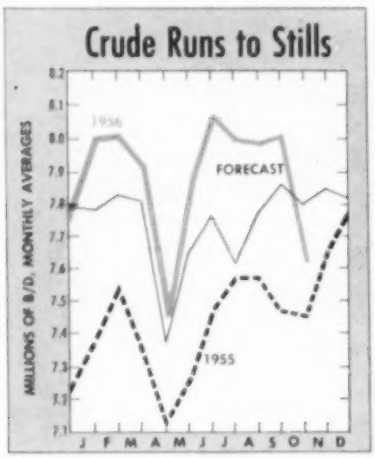
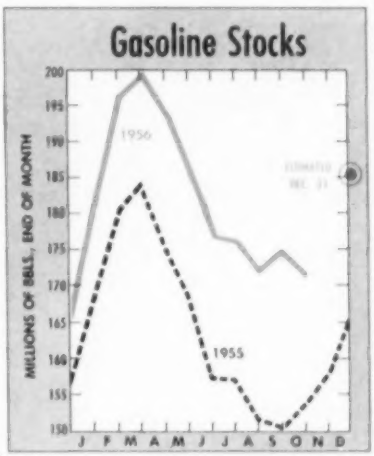
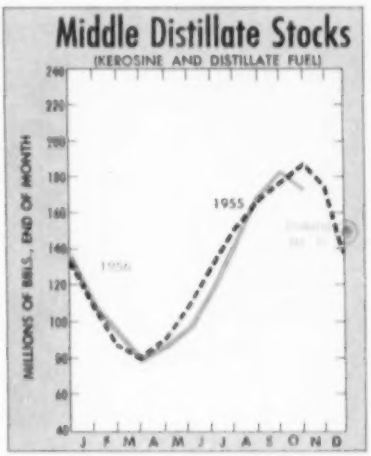






Stocks the Key to 1957 Operations

THE FORECASTS of normal petroleum product supply - demand for 1957 which have been made by PETROLEUM PROCESSING and by other agencies (see pg. 35), are based on a refinery operating rate which will make no such addition to product inventories as have occurred in 1956.

Stocks of gasoline, kerosine, middle distillate oils and residual fuels by Dec. 31, 1957, in each instance are expected to be about at their levels at the end of 1956. The high rate of crude runs for most of 1956, created inventories for the large volume products which are believed adequate for normal demand through 1957, except for gasoline, which stocks are considered topheavy.

From present indications, however, U. S. refiners in the coming year are likely to be called on to supply additional product requirements from foreign sources, resulting from the interruption of petroleum traffic through the Suez Canal. Product inventories here will not only be the barometer of changes in the trend of domestic demand, but also of the outside emergency requirements and of the rate of refinery operations here in relation to overall demand.

OUTLOOK: Fourth quarter normal gasoline demand may reach 3,880,000 bbl daily average, nearly 4.5% larger than in 1955.

Heavy additional demands for fuel oils, for example, if met entirely by running more crude to stills, could add materially to the already heavy gasoline inventories in refiners' tanks. Significant changes in inventory trends in the coming weeks and months, as compared with the same period in 1956, will be watched as a more important barometer of refining operations than in normal years.

Gasoline inventories at refineries have reflected the large cuts in runs of crude to stills which started with the fourth quarter. Total U. S. stocks Oct. 26, however, were 171,985,000 bbl, 20,378,000 bbl (13.5%) higher than Oct. 28, 1955. All districts showed significant changes except California.

U. S. Distillate fuel oil stocks of 156,851,000 bbl Oct. 26 were 5,285,000 bbl (3.5%) higher than Oct. 28, 1955.

Offsetting the increase in distillate fuel oil inventories, kerosine stocks Oct. 26 were nearly 2,000,000 bbl less than last year. Residual fuel oil stocks, at 47,493,000 bbl Oct 26, were 1,194,000 bbl (2.6%) larger than Oct. 28, 1955.

OCTOBER KEY STATISTICS

(Figures given in terms of millions of b/d, monthly averages, except stocks, which are in millions of bbls. at end of month)

	Oct. 1956	Sept. 1956	Oct. 1955
CRUDE OIL			
U. S. Production	6.997	7.047	6.831
Imports	.999	1.042	.821
U. S. Stocks	283.164	278.415	259.201
Runs to Stills	7.625	8.030	7.465
GASOLINE			
Refinery Output	3.744	3.931	3.766
Refinery Demand	3.939	4.052	3.740
Primary Stocks	193.311	175.086	153.103
MIDDLE DISTILLATES			
Refinery Output	2.136	2.151	1.921
Refinery Demand	1.851	1.698	1.631
Primary Stocks	172.443	184.430	188.993
RESIDUALS			
Refinery Output	1.106	1.103	1.123
Imports & Other	.462	.423	.354
Total Supply	1.568	1.526	1.477
Refinery Demand	1.553	1.504	1.453
Primary Stocks	47.906	47.441	47.040

PRODUCT AND CRUDE PRICES

(Products—¢ gal, weighted average prices in principal refinery markets
Crudes—$/bbl, principal fields
Source—Platt's Oilgram Price Service)

	Oct. 1956	Sept. 1956	Oct. 1955
Gasoline (regular)	11.88	12.00	11.81
Distillate Fuel Oil	9.40	9.31	8.87
Kerosine	11.05	10.93	10.33
Residuals	5.26	5.26	4.79
Above 4 Products	9.48	9.52	9.19
Lube Oils	22.86	22.86	19.07
Crude	2.84	2.84	2.83

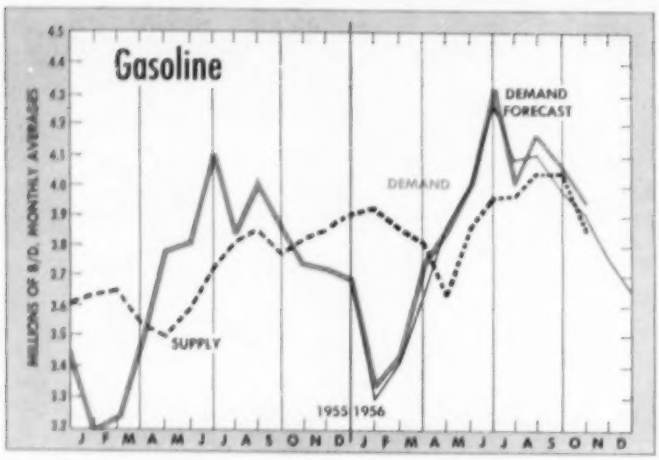
REFINERY YIELDS

% on Crude Runs to Stills

	Oct. 1956	Sept. 1956	Oct. 1955
Gasoline	44.6	44.4	44.8
Kerosine	4.7	4.1	4.1
Distillate	23.3	22.6	21.3
Residuals	14.5	13.7	14.9

SOURCE OF DATA (except prices): Sept. and Oct., API weekly reports; earlier months, Bureau of Mines

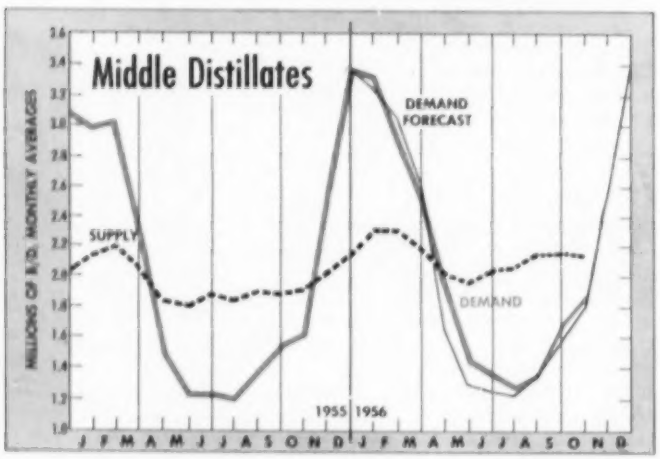
Gasoline Supply Drops As Runs Are Cut



MOTOR FUEL

	From Crude		From Nat. Gas		Total
SUPPLY (Millions of b/d)					
Oct. '56	3.403		.451		3.854
Oct. '55	3.382		.445		3.827
Change	+ .021	+	.006	+	.027
% Change	+ 0.6	+	1.3	+	.07
DEMAND (including exports) (Millions of b/d)					
Oct. '56					3.939
Oct. '55					3.740
Change				+	.199
% Change				+	5.3
TOTAL SUPPLY (Millions of bbl)					
10 Mos. '56	1,053.926		135.457		1,189.383
10 Mos. '56	995.141		128.762		1,123.903
Change	+ 59.785	+	6.695	+	65.480
% Change	+ 5.9	+	5.2	+	5.8
TOTAL DEMAND (including Exports) (Millions of bbl)					
10 Mos. '56					1,188.938
10 Mos. '56					1,130.212
Change				+	58.776
% Change				+	5.2

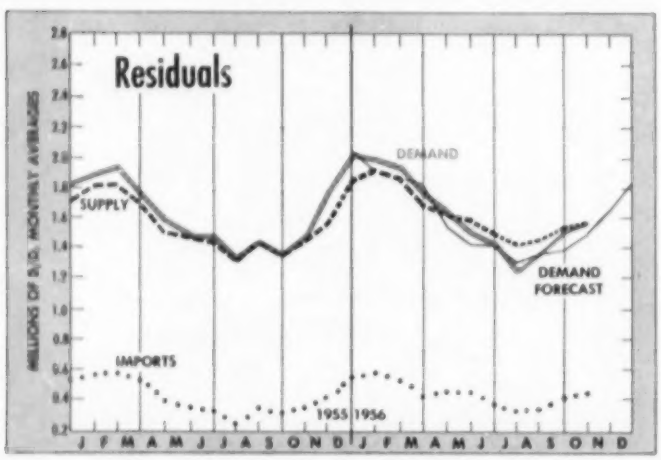
Distillate Demand Follows Seasonal Trend


Middle Distillates
DEMAND FORECAST
SUPPLY
DEMAND
1955 1956
MILLIONS OF B/D. MONTHLY AVERAGES
J F M A M J J A S O N D J F M A M J J A S O N D

MIDDLE DISTILLATES

	Kerosine		Dist. Fuel Oil		Total
PRODUCTION (Millions of b/d)					
Oct. '56	.357		1.779		2.136
Oct. '55	.309		1.612		1.921
Change	+ .048	+	.167	+	.215
% Change	+ 15.5	+	10.4	+	11.2
DEMAND (including exports) (Millions of b/d)					
Oct. '56	.313		1.538		1.851
Oct. '55	.297		1.334		1.631
Change	+ .016	+	.204	+	.220
% Change	+ 5.4	+	15.3	+	13.5
TOTAL PRODUCTION (Millions of bbl)					
10 Mos. '56	100.347		548.447		648.794
10 Mos. '55	96.613		498.061		594.679
Change	+ 3.729	+	50.386	+	54.115
% Change	+ 3.9	+	10.1	+	9.1
TOTAL DEMAND (including Exports) (Millions of bbl)					
10 Mos. '56	94.262		507.252		601.514
10 Mos. '55	87.739		458.525		546.264
Change	+ 6.523	+	48.727	+	55.250
% Change	+ 7.4	+	10.6	+	10.1

Residual Fuel Oil Demand Remains Steady


Residuals
DEMAND
SUPPLY
DEMAND FORECAST
IMPORTS
1955 1956
MILLIONS OF B/D. MONTHLY AVERAGES
J F M A M J J A S O N D J F M A M J J A S O N D

RESIDUAL FUELS

	Refinery Output		Imports & Others		Total
SUPPLY (Millions of b/d)					
Oct. '56	1.106		.462		1.568
Oct. '55	1.123		.354		1.477
Change	— .017	+	.108	+	.091
% Change	— 1.5	+	30.5	+	6.1
DEMAND (including exports) (Millions of b/d)					
Oct. '56				+	1.553
Oct. '55				+	1.453
Change				+	.100
% Change				+	6.9
TOTAL SUPPLY (Millions of bbl)					
10 Mos. '56	353.240		138.167		491.407
10 Mos. '55	344.040		125.398		469.438
Change	+ 9.200	+	12.769	+	21.969
% Change	+ 2.7	+	10.2	+	4.7
TOTAL DEMAND (including Exports) (Millions of bbl)					
10 Mos. '56					482.870
10 Mos. '55					474.503
Change				+	8.367
% Change				+	1.8

SOURCE OF DATA: Sept. and Oct., API weekly reports, earlier months, Bureau of Mines (1956 figures for 366 days)

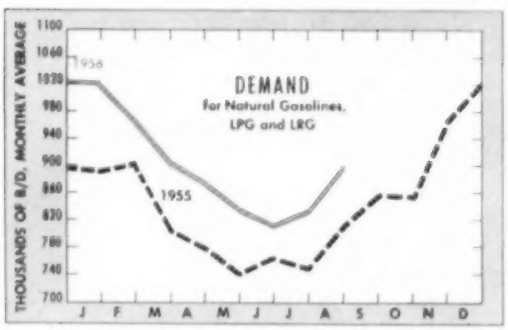
RUNS TO STILLS AND DISTRIBUTION OF PRIMARY STOCKS BY U. S. REFINERY DISTRICTS

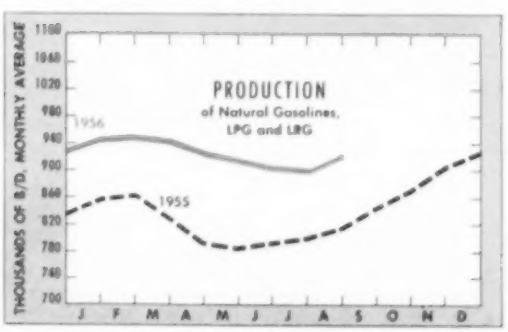
(Primary stocks include those at refineries, at large terminals and in pipelines; all data based on API reports)

District	RUNS TO STILLS (Millions of b/d average for week ending on date shown) Oct. 26 1956	Oct. 28 1955	Change	% Change	GASOLINE STOCKS (Millions of bbl on date shown) Oct. 26 1956	Oct. 28 1955	Change	% Change	RESIDUAL STOCKS (Millions of bbl on date shown) Oct. 26 1956	Oct. 28 1955	Change	% Change
East Coast	1.174	1.087	+ .087	+ 8.0	41.778	35.045	+ 6.733	+19.2	12.393	13.500	— 1.107	— 8.2
Gulf Coast	2.526	2.464	+ .062	+ 2.5	34.181	28.710	+ 5.471	+19.1	8.107	8.128	— .021	— 0.3
Total Coastal	3.700	3.551	+ .149	+ 4.2	75.959	63.755	+12.204	+19.1	20.500	21.628	— 1.128	— 5.2
Appalachian	.154	.205	— .021	—20.2	7.131	6.635	+ .496	+ 7.5	.795	1.033	— .238	—23.0
Ind.-Ill.-Ky.	1.400	1.367	+ .033	+ 2.4	32.933	30.843	+ 2.090	+ 6.8	6.099	5.147	+ .952	+18.5
Okla.-Kans.-Mo.	.638	.671	— .033	— 4.9	17.491	14.504	+ 2.987	+20.6	1.620	1.448	+ .172	+11.9
Other Inland	.610	.599	+ .011	+ 1.8	17.016	14.543	+ 2.473	+17.0	3.030	2.336	+ .694	+29.7
Total Inland	2.832	2.842	— .010	— 0.3	74.571	66.525	+ 8.046	+12.1	11.544	9.964	+ 1.580	+15.9
Total East of Calif.	6.532	6.393	+ .139	+ 2.2	150.530	130.280	+20.250	+15.5	32.044	31.592	+ .452	+ 1.4
Calif.	1.138	1.083	+ .055	+ 5.1	21.455	21.327	+ .128	+ 0.6	15.449	14.707	+ .742	+ 5.0
Total U. S.	7.670	7.476	+ .194	+ 2.6	171.985	151.607	+20.378	+13.5	47.493	46.299	+ 1.194	+ 2.6

District	DISTILLATE FUEL OIL STOCKS (Millions of bbl on date shown) Oct. 26 1956	Oct. 28 1955	Change	% Change	KEROSINE STOCKS (Millions of bbl on date shown) Oct. 26 1956	Oct. 28 1955	Change	% Change	TOTAL MIDDLE DISTILLATE STOCKS (Millions of bbl on date shown) Oct. 26 1956	Oct. 28 1955	Change	% Change
East Coast	59.698	57.849	+ 1.849	+ 3.2	13.993	14.984	— .991	— 6.6	73.691	72.833	+ .858	+ 1.2
Gulf Coast	24.718	22.597	+ 2.121	+ 9.4	5.840	6.253	— .413	— 6.6	30.558	29.850	+ 1.708	+ 5.9
Total Coastal	84.416	80.446	+ 3.970	+ 4.9	19.833	21.237	— 1.404	— 6.6	104.249	101.683	+ 2.566	+ 2.5
Appalachian	4.529	4.482	+ .047	+ 1.0	1.333	1.294	+ .039	+ 3.0	5.862	5.776	+ .086	+ 1.5
Ind.-Ill.-Ky.	28.946	29.677	— .731	— 2.5	8.533	9.182	— .649	— 7.1	37.479	38.859	— 1.380	— 3.6
Okla.-Kans.-Mo.	18.017	16.100	+ 1.917	+11.9	2.596	2.411	+ .185	+ 7.7	20.613	18.511	+ 2.102	+11.4
Other Inland	7.239	8.010	— .771	— 9.6	1.841	1.961	— .120	— 6.1	9.080	9.971	— .891	— 8.9
Total Inland	58.731	58.269	+ .462	+10.8	14.303	14.848	— .545	— 3.7	73.034	73.117	— .083	— 0.1
Total East of Calif.	143.147	138.715	+ 4.432	+ 3.2	34.136	36.085	— 1.949	— 5.4	177.283	174.800	+ 2.483	+ 1.4
Calif.	13.704	12.851	+ .853	+ 6.6	.382	.351	+ .031	+ 8.8	14.086	13.202	+ .884	+ 6.7
Total U. S.	156.851	151.566	+ 5.285	+ 3.5	34.518	36.436	— 1.918	— 5.3	191.369	188.002	+ 3.367	+ 1.8

Natural Gas and Refinery Gas Liquids





SUPPLY AND DEMAND STATISTICS

(Bureau of Mines Data)

CURRENT PRODUCTION (1000 b/d monthly average)	Aug. 1956	July 1956	Aug. 1955
At Natural Gasoline and Cycling Plants			
Liquefied Petroleum Gas	391	385	328
Natural Gasoline and Isopentane	308	303	283
Condensate	24	22	20
Finished Gasoline, Naphtha and other	55	55	63
Total Natural Gasoline and Cycling Plant Production	778	745	699
Liquefied Refinery Gases	139	147	119
Total Marketable Gas Liquids	917	892	818
Lease Condensate	111	115	104
Total Natural Gas Liquids	1,028	1,007	922

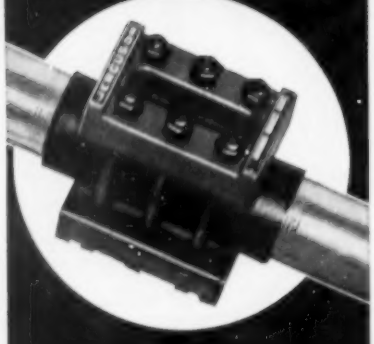
CURRENT DEMAND (1000 b/d monthly average)			
LPG and LRG	500	451	431
Natural Gasoline, Isopentane and other	391	376	384
Total Marketable Gas Liquids	891	827	815

CUMULATIVE PRODUCTION (1000 bbl)	Aug. 1956	Aug. 1955
LPG and LRG	132,188	111,462
Natural Gasoline, Isopentane and Other	92,109	87,381
Total Marketable Gas Liquids	224,297	198,843

CUMULATIVE DEMAND (1000 bbl)		
LPG and LRG	125,270	107,240
Natural Gasoline, Isopentane and Other	91,075	87,779
Total Marketable Gas Liquids	216,345	195,019

STOCKS (1000 bbl, end of month)	Aug. 1956	July 1956	Aug. 1955
LPG and LRG	14,679	13,717	11,980
Natural Gasoline, Isopentane and other	5,134	5,626	4,728
Total Stocks	19,813	19,343	16,708

NEW . . .
Jerguson Sight Flow Indicators



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Do you need detailed information on a specific subject? Check through this easy-to-use index of literature and data being offered in this issue's advertisements.

AGITATORS, radial propeller, bulletin 58-W; Struthers Wells Corp. See adv't. p. 81.

AIR-WATER SEPARATORS, prevents air corrosion, bulletins; Condenser Service & Engr. Co., Inc. See adv't. p. 106.

ALUMINA, fused, for reactors, booklet; Norton Co. See adv't. p. 30.

ANALYSIS, process, mass spectrometer, bulletin CEC 1839-X27; Consolidated Electrodynamics Corp. See adv't. p. 76.

CATALYST, for "Pentafining," information; Atlantic Refining Co. See adv't. pp. 32-33.

CATALYSTS, many kinds, booklet; Harshaw Chemical Co. See adv't. p. 86.

CLEANER, hydraulic jet, bulletin 424; Sellers Injector Corp. See adv't. p. 124.

CLEANING COMPOUNDS, and equipment, for process vessels, booklet; Oakite Products, Inc. See adv't. p. 136.

FLOW INDICATORS, line of sight, data unit; Jerguson Gage & Valve Co. See adv't. p. 112.

FLOW TRANSMITTER, electrical or pneumatic, bulletin 170; Brooks Rotameter Co. See adv't. p. 131.

GAGES, liquid level, direct reading, catalog 36; Penberthy Mfg. Co. See adv't. p. 145.

GREASE THICKENER, Estersil GT, information and samples; E. I. DuPont de Nemours & Co., Inc. See adv't. p. 98.

HEADERS, cold extruded, bulletin CE-0.001; Fluor Products Co. See adv't. cover 4.

MIST ELIMINATORS, bulletin ME-6; Metal Textile Corp. See adv't. p. 125.

MIXERS, side and top entering, 8 catalogs and data sheets; Mixing Equipment Co., Inc. See adv't. p. 34.

MIXING AND BLENDING, by jet eductors, catalog J-1; Schutte & Koerting Co. See adv't. p. 18.

OXYGEN ANALYSERS, for control, data file 20J-126; A. O. Beckman, Inc. See adv't. p. 130.

PIPE ELBOWS, welding type, catalog 54; Midwest Piping Co., Inc. See adv't. p. 94.

REFRACTORY, hydraulic setting, gun or trowel, brochure RC-28A; Johns-Manville Corp. See adv't. p. 132.

REFRACTORIES, castable, catalog; Bigelow-Liptak Corp. See adv't. p. 141.

RUPTURE DISCS, for pressure relief, information; Black, Sivalls & Bryson, Inc. See adv't. p. 122.

SOLVENT DECARBONIZING, booklet; M. W. Kellogg Co. See adv't. p. 20.

STEAM TRAPS, brochures and technical data; Clark Mfg. Co. See adv't. p. 107.

STEAM TRAPS, trap selector booklet; V. D. Anderson Co. See adv't. p. 138.

STEAM TRAPS, bulletin 10-55; W. H. Nicholson & Co. See adv't. p. 133.

SULFURIC ACID, technical bulletin on uses; General Chemical Div. See adv't. cover 3.

TUBE MAINTENANCE TOOLS, literature; Airetool Mfg. Co. See adv't. p. 142.

VALVES, general purpose, drop forged, catalog F-9; Henry Vogt Machine Co. See adv't. p. 84.

WALKWAYS, and gratings, steel, catalog PP-126; Standard Steel Spring Div. See adv't. p. 134

300,000 b/d

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The Petroleum Processing Reader Service Department will give your inquiries prompt and efficient handling.

ADVERTISERS' INDEX

A

Air Preheater Corp. (C-4) 70
Airetool Mfg. Co. (H-6) 142
American Cyanamid Co., Refinery Chemicals Dept. (A-9) 17
American Petroleum Institute (E-5) 104
Anaconda Co. (C-9) 77
Anderson Co., V. D. (H-2) 138
Annin Co. (G-6) 134
Atlantic Refining Co. (C-1) 32-33

B

Babcock & Wilcox Co., Tubular Products Div. (J-4) 153
Babcock & Wilcox Co., Boiler Div. (B-6) 26-27
Beckman, Inc., A. O. (G-2) 130
Bethlehem Steel Co. (H-1) 137
B-I-F Industries, Inc., Proportioneers (A-1) Cover 2
Bigelow-Liptak Corp. (H-5) 141
Black, Sivalls & Bryson, Inc., Controls Div. (C-3) 69
Black, Sivalls & Bryson, Inc., Safety Heads Div. (F-2) 122
Brooks Rotameter Co. (G-3) 131

C

Catawissa Valve & Fittings Co. (F-9) 128
Clark Mfg. Co. (E-7) 107
Condenser Service & Engr. Co. (E-6) 106
Consolidated Electrodynamics Corp. (C-8) 76
Crane Co. (C-7) 72

D

Davison Chemical Co., Div. W. R. Grace & Co. (E-8) 108
Delta Tank Mfg. Co., Inc. (B-4) 23
Droke & Associates, J. W. (E-4) 103
DuPont de Nemours & Co., Inc. (J-3) 149-150
DuPont de Nemours & Co., Inc (E-2) 98

E

Enjay Co. (F-3) 123
Ethyl Corp. (A-3) 4-5

F

Fisher Governor Co. (D-7) 90
Fluor Products Corp. (J-7) Cover 4
Foster Wheeler Corp. (E-3) 113

G

Gas Atmospheres, Inc. (J-1) 146
General American Trans. Corp., Plate & Welding Div., (A-4) 6
General American Trans. Corp., Terminals Div. (A-5) 8
General Chemical Div., Allied Chem. & Dye Corp. (J-6) Cover 3

H

Harshaw Chemical Co. (D-5) 86
Hercules Powder Co. (A-6) 11
Houdry Process Corp. (C-5) 70A

J

Jerguson Gage & Valve Co. (E-9) 112
Johns-Manville Corp. (G-4) 132

K

Kellogg Co., M. W., Fabricated Products Div. (F-7) 127
Kellogg Co., M. W., Refinery Process Div. (B-2) 20
Koch Engineering Co. (D-6) 89

L

Linde Air Products Co., Div. U. C. C. (J-5) 154
Lummus Co. (A-7) 13

M

McKee Co., Arthur G. (D-3) 82
Metal Textile Corp. (F-5) 125
Midwest Piping Co. (D-9) 94
Mixing Equipment Co., Inc. (C-2) 34
Moore & Co., Samuel (A-8) 14

N

Nicholson & Co., W. H. (G-5) 133
Norton Co. (B-8) 30

O

Oakite Products, Inc. (G-9) 136
Oil Well Supply Co. (A-2) 1
Oronite Chemical Co. (G-8) 135

P

Penberthy Injector Co. (H-9) 145
Petreco (E-1) 97
Petro-Chem Development Co., Inc. (D-1) 78
Powell Co., William (C-6) 70B

R

Refinery Engineering Co. 93
Ridge Tool Co. (F-6) 126
Rockwell-Nordstrom Valves (B-5) 24-25

S

Schutte & Koerting Co. (B-1) 18
Sellers Injector Corp. (F-4) 124
Shell Oil Co. (G-1) 129
Standard Steel Spring Div. (G-7) 134
Struthers Wells Corp. (D-2) 81

T

Thermo Electric Co., Inc. (H-4) 140
Tickle Engineering Works, Arthur (H-8) 144
Tretolite (J-2) 147

U

United Chem. Corp. of New Mexico (F-8) 128
U. S. Steel Corp. (F-1) 121
Universal Oil Products Co. (B-7) 28-29
Universal Oil Products Co., Products Dept. (H-3) 139

V

Vogt Machine Co., Henry (D-4) 84

W

Western Supply Co. (H-7) 143
Westvaco Mineral Products Div. (B-9) 31
Wolverine Tube, Div. Calumet & Hecla, Inc. (B-3) 21-22

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21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

(B) ADVERTISED PRODUCTS *See Index on facing page*

A1	B1	C1	D1	E1	F1	G1	H1	J1	K1	L1	M1	N1	O1	P1	Q1	S1	T1	U1	V1
A2	B2	C2	D2	E2	F2	G2	H2	J2	K2	L2	M2	N2	O2	P2	Q2	S2	T2	U2	V2
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A4	B4	C4	D4	E4	F4	G4	H4	J4	K4	L4	M4	N4	O4	P4	Q4	S4	T4	U4	V4
A5	B5	C5	D5	E5	F5	G5	H5	J5	K5	L5	M5	N5	O5	P5	Q5	S5	T5	U5	V5
A6	B6	C6	D6	E6	F6	G6	H6	J6	K6	L6	M6	N6	O6	P6	Q6	S6	T6	U6	V6
A7	B7	C7	D7	E7	F7	G7	H7	J7	K7	L7	M7	N7	O7	P7	Q7	S7	T7	U7	V7
A8	B8	C8	D8	E8	F8	G8	H8	J8	K8	L8	M8	N8	O8	P8	Q8	S8	T8	U8	V8
A9	B9	C9	D9	E9	F9	G9	H9	J9	K9	L9	M9	N9	O9	P9	Q9	S9	T9	U9	V9

(C) REPRINTS AVAILABLE *See listing on next page*

R1	R4	R7	R10	R13	R16	R19	R22	R25	R28	R31	R34	R37	R40	R43	R46				
R2	R5	R8	R11	R14	R17	R20	R23	R26	R29	R32	R35	R38	R41	R44	R47				
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61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

B ADVERTISED PRODUCTS *See Index two pages back*

A1	B1	C1	D1	E1	F1	G1	H1	J1	K1	L1	M1	N1	O1	P1	Q1	S1	T1	U1	V1
A2	B2	C2	D2	E2	F2	G2	H2	J2	K2	L2	M2	N2	O2	P2	Q2	S2	T2	U2	V2
A3	B3	C3	D3	E3	F3	G3	H3	J3	K3	L3	M3	N3	O3	P3	Q3	S3	T3	U3	V3
A4	B4	C4	D4	E4	F4	G4	H4	J4	K4	L4	M4	N4	O4	P4	Q4	S4	T4	U4	V4
A5	B5	C5	D5	E5	F5	G5	H5	J5	K5	L5	M5	N5	O5	P5	Q5	S5	T5	U5	V5
A6	B6	C6	D6	E6	F6	G6	H6	J6	K6	L6	M6	N6	O6	P6	Q6	S6	T6	U6	V6
A7	B7	C7	D7	E7	F7	G7	H7	J7	K7	L7	M7	N7	O7	P7	Q7	S7	T7	U7	V7
A8	B8	C8	D8	E8	F8	G8	H8	J8	K8	L8	M8	N8	O8	P8	Q8	S8	T8	U8	V8
A9	B9	C9	D9	E9	F9	G9	H9	J9	K9	L9	M9	N9	O9	P9	Q9	S9	T9	U9	V9

C REPRINTS AVAILABLE *See listing*

R1	R4	R7	R10	R13	R16	R19	R22	R25	R28	R31	R34	R37	R40	R43	R46
R2	R5	R8	R11	R14	R17	R20	R23	R26	R29	R32	R35	R38	R41	R44	R47
R3	R6	R9	R12	R15	R18	R21	R24	R27	R30	R33	R36	R39	R42	R45	R48

D NEW OR RENEWAL SUBSCRIPTION

New ☐ Renewal ☐ 1 year—$2.00 ☐ 2 years—$3.00 ☐ 3 years—$4.00 ☐

Petroleum Processing

For Issue of December, 1956 (Good until March 15, 1957)

Name *(please print)* _____

Position _____

Company _____

Business Address _____

City _____ Zone _____ State _____

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The Latest in . . .

PETROLEUM PROCESSING Reprints

(For complete Reprint List, see p. 119)

Use **Reader Service Card** Area **"C"** to order the reprints you want. We'll fill your order and send you a bill. **If you don't see the item you want** listed below, check the additional Reprint Listings on page 119.

- **'Instrument Charts' Track Costs**—the unique use of control charts by British American Oil Co. to tell when operating costs are out of limits. 8 pages—$0.25: Circle **R36**

- **Hydrogen Processing** in the Refinery—Special Report on what it is, how it works, who uses it, what processes and catalysts are available. 24 pages—$0.75: Reprint **R30**

- **Drafting Production Manual**—tricks of the trade for better and faster drawing board work, with do-it-yourself slide rule for flange and fitting drafting data. 24 pages—$1.25: Reprint **R31**

- **Optimum Bubble-Cap Tray Design**—for process design of bubble-cap trays. 56 pages—$1.50: Circle **R15**

- **Vaporization Equilibrium Constant and Activity Coefficient Charts.** 48 pages—$1.50: Circle **R1**

- **Chemical Treating of Petroleum Fuels**—to remove and/or convert impurities. 24 pages—$0.75: circle **R12**

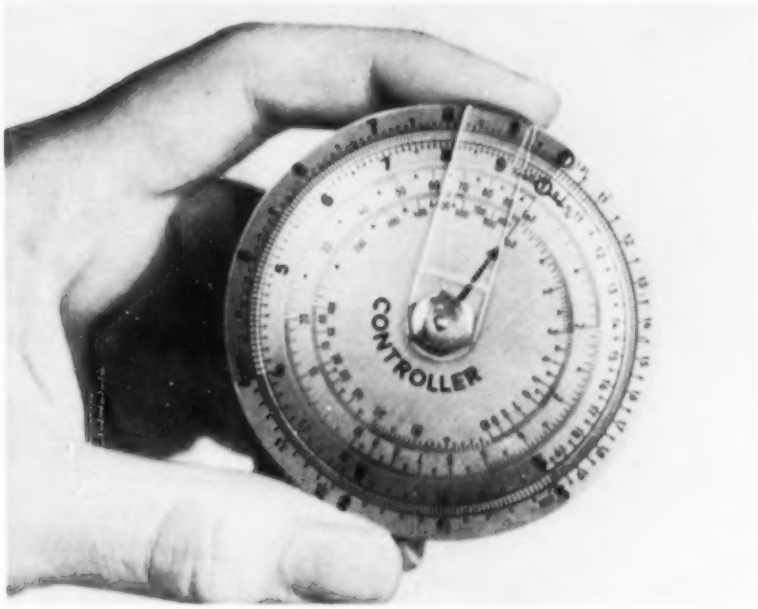
- **Clip·n·File Sheets**—$0.20 each, any 6 for $1.00. Process Data Sheets **(PDS's)** are 3-page fold-outs. Engineering Data Sheets **(EDS's)** are 2 pages on special, heavy paper for repeated handling and reference:

PDS 12, **Process Reference List—1954**	Reprint **R32**
PDS 13, **Thermofor Catalytic Reforming**	Reprint **R34**
EDS 11, **Measuring Viscosity**	Reprint **R33**
EDS 12, **Metals Glossary**	Reprint **R35**

(For preceding PDS and EDS sheets, see complete listing on page 119 of this issue.)

Prices for quantity orders furnished on request

WHAT'S NEW...



Pocket Size Controller . . .

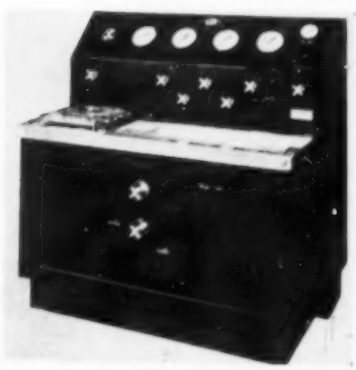
Performs Many Calculating Functions

Using a novel color code, this imported calculator squeezes a lot of information into a small package. Measuring less than 3 inches in diameter it has the accuracy and calculating ability of a 9-in. linear slide rule. Besides the regular logarithmic multiplication-division scales, the Controller offers direct reading of square and cube values for any number.

Made of treated aluminum that weighs only 1 oz, the calculator has the values and markings photographically projected onto its surfaces in three colors. These colors indicate the value of the smallest subdivisions printed within their range, thus aiding in quick interpretation of answers.

On the back of the aluminum disc are conversion tables for weight, volume and length units which are used in Europe, and some of their American values. National distributor for this imported calculator is **Silver Bells Limited,** 600 Sixteenth St., Oakland, Calif.

Circle No. **1** *on Reply Card*



Test Stand

. . . **for safety valves** is available as a package unit and accommodates flanged and screwed valves from ¼- to 4-in.

The test stand will give accurate readings for pressures between 0 and 1000 psi on the standard model, with other units available that will test to 10,000 psi. A known pressure of either air or controlled fluid is applied to the valves to check the set relief points.

Needed for operation of the self-contained unit is a source of 0 to 100 psi air at 1 cfm. The test stand can also be used for checking tank leakage, casting porosity, and other similar uses through a panel spud if desired. **Industrial Engineering Corp.,** 525 E. Woodbine, Louisville 8, Ky.

Circle No. **2** *on Reply Card*

Leak-Proof Blower

. . . **handles radioactive, toxic or corrosive gases** at high temperatures and pressures. It will handle 20 cfm of gas having a specific gravity of 6, and develops a 150-ft head in a 2000 psi system. Operating temperatures can be up to 500°F.

The unit consists of a centrifugal blower and canned motor sealed in a heavy stainless steel enclosure. Motor rotor and bearing components are located in the lower portion of the unit, which is filled with water. Water is circulated through built-in coils to remove heat from the motor and maintain a temperature less than 210°F in the rotor and bearing cavity.

Fluid piston radial and thrust bearings make a leakproof design. An auxiliary pump impeller mounted on the main blower shaft pressurizes the bearings, so that contact between the shaft and bearing occurs only during startup or shutdown. **Allis-Chalmers Manufacturing Co.,** Milwaukee 1, Wis.

Circle No. **3** *on Reply Card*

Portable Pyrometer

. . . **tests six types** of thermocouples and measures DC potentials from 0 to 155 millivolts.

Known as "Pyrotest 9B," the new unit has nine interchangeable scales

and may be used to check and calibrate any temperature recorder, indicator or controller operating within a range of 32°F and 3215°F and employing any type of thermocouple.

Scales are interchangeable within 30 seconds; temperatures or millivolts are read directly. No charts, graphs or conversion tables are required. Each scale is a deep photoetched aluminum disc, with temperature readings available in either °F or °C.

Accuracy of the Pyrotest is 1/6 of 1% of scale spans. Slide wire resolution exceeds 4,000 increments. Effective open scale length is 50½-in. The instrument is completely self-contained with a built-in power supply. Total weight is 14 lbs. **Technique Associates, Inc.,** 211 E. South St., Indianapolis 25, Ind.

Circle No. **4** *on Reply Card*

Flow Transmitters

. . . **for rotameters** operate either electrically or pneumatically. Conversion from one system to the other can be made without removing the rotameter from the flow line.

Labelled the "TransiTwins," these flow transmitters use either a force-balance principle in the pneumatic type or a strain gauge element in the electric twin for improved response time and low inertia characteristics. The transmitters feature a machined base which is completely manifolded for all piping connections. Purging connection, steam jacketing connections as well as the process connection are all concentrated on the standard base. A weather-tight and chemical-resistant fibre glass case protects each transmitter. **Brooks Rotameter Co.,** Lansdale, Pa.

Circle No. **5** *on Reply Card*

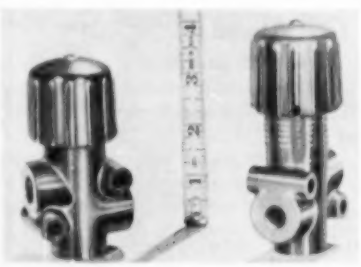
Electronic Tester . . .

Finds Defects in Non-Magnetic Material

This new nondestructive tester automatically locates defects in aluminum, brass, copper, austenitic steel and titanium when rod or piping is passed through it. Located are such defects as inclusions, voids concentrated porosity, splits, seams, overlapping and diameter changes. It is suitable for the inspection of condenser and compressor tubing, copper piping and other special non-magnetic material.

The Magnatest FW-400 is actually a series of instruments that will make either absolute or differential tests on metal pipe, tubing or rod. The absolute tests are used whenever hardness or alloy content changes must be found. The differential tests are used to detect abrupt changes such as faulty seams or lapping. Defects may be noted by either alarm signals or continuous chart recording. Diameters that can be handled range from 1/64 to 3 in. **Magnaflux Corporation,** 7300 West Lawrence Ave., Chicago 31, Ill.

Circle No. **6** *on Reply Card*



Small Plastic Valve

. . . **operates up to 170 psi** on continuous duty, and up to 170°F in lower pressure systems for intermittent duty.

Made of polyvinyl chloride (PVC), the valve has excellent corrosion resistance, immunity to electrolysis and galvanic action, and constant flow characteristics. It will withstand most of the chemicals that stainless steel will, and many others.

The valves are available in sizes of ⅛ and ¼ in. and in two basic types. The needle valve has a rising spindle with a "Kel-F" needle for non-sticking and corrosion resistance. The globe valve has a seating disc of Teflon for the same purposes. Both

valves have O-ring type spindle seals. Working parts are sealed against interior and exterior corrosion. The valves have mounting bosses with clearance for ¼-in. bolts. **Chemtrol Corp.,** 11008 Santa Fe Ave., Lynwood, Calif.

Circle No. **7** *on Reply Card*

New Liquid Meter

. . . **uses control plate and control arms** for quiter operation and longer life.

Replacing the gear arrangements of previous Rotocycle meters with a new crank-type linkage for gear control means a fewer number of parts plus stronger control of vane positioning. Simplicity of measuring element parts in the new meters makes it much easier to keep them in proper timing, too.

The new crank-type rotors are interchangeable with rotors of the Rotocycle meters already in the field. Their removal and inspection is an easy matter. Meter and Valve Division, **Rockwell Manufacturing Co.,** 400 North Lexington Ave., Pittsburgh 8, Pa.

Circle No. **8** *on Reply Card*

Expendable Pallet

. . . **made of paperboard** handles up to 1 ton of bagged, cartoned or bulk material.

Weighing only 5 lb, the Model P tray-type pallets are loaded and secured like wooden pallets. They are delivered knocked down, thus conserving storage space until needed. These expendable pallets eliminate return shipping costs and repair and inventory of the usual wooden pallets. **Titan Pallet Co., Inc.,** 527 Madison Ave., New York 22, N. Y.

Circle No. **9** *on Reply Card*

(Continued on p. 120)

You Can Add These

PETROLEUM PROCESSING Reprints

To Your Files

(Use the Readers Service Cards on pages 115-116 to order)

PETROLEUM PROCESSING Special Reports:

Hydrogen Processing—An Appraisal of Its Use in the Refinery, by Robert L. Davidson; what it is, how it works, what it does, its future, who's using it or planning to use it, commercial processes and catalysts available. 24 pages, November 1956
order Reprint **R30** . . $0.75

Evaporation Losses—And Their Control in Storage, by Willis A. Bussard; what evaporation is, storage conditions that affect it, equipment and other methods to reduce losses, estimating losses, selecting the right tank. 24 pages, July 1956 order Reprint **R20** . . $0.75

Heat Exchangers—And Their Use in Processing Petroleum, by Daniel A. Donahue; what they are, how they're made, how to design them, where to use them, how they are installed and operated, how to maintain them, how much they cost. 32 pages, March 1956
order Reprint **R8** . . $1.00

Catalytic Reforming—And Aromatics Recovery in the Refinery, by Virgil B. Guthrie and Robert L. Davidson; what it is and does, how it works, who's using it or planning to use it, commercial processes you can use for catalytic reforming and aromatics recovery. 48 pages, August 1955 order Reprint **R3** $0.75

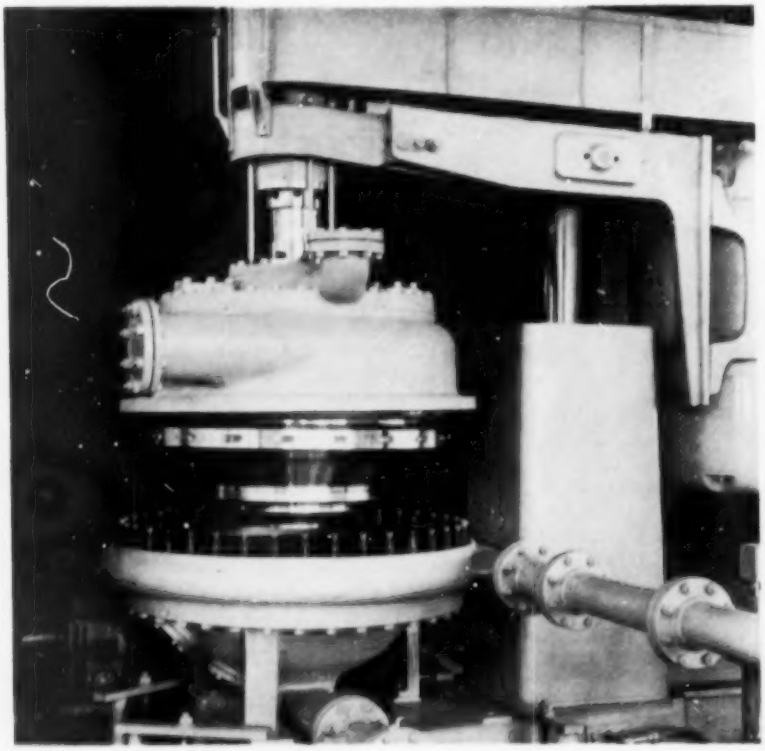
PETROLEUM PROCESSING Data Sheets:

Process Data Sheets are process descriptions with flow diagrams, process conditions, economics, etc. 3-page fold-out sheets—$0.20 each, or any 6 PDS or EDS sheets for $1.00:

PDS 1, **Ethylene Oxide** Reprint **R4**
PDS 2, **Butadiene.Butenes** Reprint **R5**
PDS 3, **L'Azote Ammonia** Reprint **R6**
PDS 4, **Ethylene—Kellogg** Reprint **R9**
PDS 5, **Fluid Coking** Reprint **R10**
PDS 6, **Chemico Urea** Reprint **R16**
PDS 7, **Ethylene—Stone & Webster** Reprint **R18**
PDS 8, **TCP—Socony Mobil** Reprint **R21**
PDS 9, **Process References—1947** Reprint **R24**
PDS 10, **Ammonia—Kellogg** Reprint **R26**
PDS 11, **Isomerization—Atlantic** Reprint **R28**
PDS 12, **Process References—1954** Reprint **R32**
PDS 13, **Thermofor Catalytic Reforming** Reprint **R34**

Engineering Data Sheets contain basic data and information on a variety of subjects. 2 pages—$0.20 each, or any 6 EDS or PDS sheets for $1.00:

EDS 1, **Pressure Fundamentals** Reprint **R7**
EDS 2, **Temperature Fundamentals** Reprint **R11**
EDS 3, **Fluid Flow Fundamentals** Reprint **R13**
EDS 4, **Flow Restrictions in Pipe** Reprint **R14**
EDS 5, **Tank Capacities—Part I** Reprint **R17**
EDS 6, **Heat—and Its Transfer** Reprint **R19**
EDS 7, **Vapor Pressure** Reprint **R22**
EDS 8, **Distillation Fundamentals** Reprint **R25**
EDS 9, **Heat Fuel Comparison** Reprint **R27**
EDS 10, **Tank Capacities—Part II** Reprint **R29**
EDS 11, **Measuring Viscosity** Reprint **R33**
EDS 12, **Metals Glossary** Reprint **R35**



Continuous Centrifuge . . .

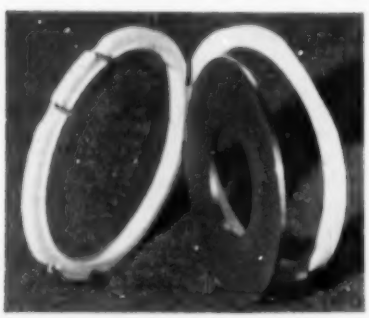
Operates at High Pressure and Temperature

This machine is designed for operation in the range of 100 psi and 300°F for the centrifugal separation of materials. It permits reducing processing time by handling hot materials without the necessity of cooling to conventional temperatures and reducing the pressure to atmospheric.

It can be used for concentration, washing or soluble recovery, clarification and classification. Any of these operations can be carried out, or changed from one to the other, merely by adjusting the necessary combination of feed, wash, recycle and product discharge rates, and rotor speed. External valving allows changing the feed composition while in operation.

This Merco Pressure Centrifuge is now available in two sizes. The PC-9 is a pilot plant model capable of handling from 1 to 20 gpm, generating a centrifugal force as high as 9,500 G's with a 9-in. rotor. The PC-30 model is for production work and equipped with a 30-in. rotor. It will treat 90 to 250 gpm at 4,000 G's. Standard models of both are made of a stainless steel rotor and cast steel housing, although other materials are available. **Dorr-Oliver Inc.,** Barry Place, Stamford, Conn.

Circle No. **10** *on Reply Card*



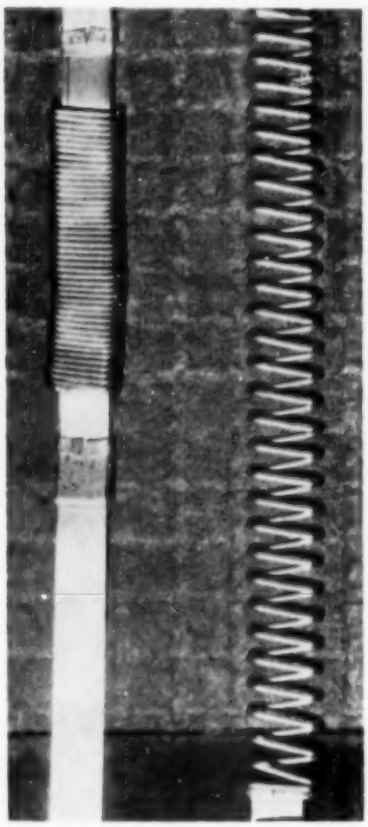
Orifice Fitting

. . . **permits expansion** and contraction but still maintains a continuous seal.

The "TS" seal is a simple, two-piece unit of Teflon that locks securely around the orifice plate with ring clips, and is recessed to receive the manufacturer's #500 orifice plate. The plate can be removed from the assembly by hand pressure alone, no tools are required.

These orifice units have an operating temperature range of —65 to +500°F, and are recommended for wet, corrosive, dry or high pressure service. They are available in sizes from 2 to 12 in., and come as standard part on the manufacturer's 900, 1500 and 2500 lb ASA fittings. **Daniel Orifice Fitting Co.,** Houston, Texas.

Circle No. **11** *on Reply Card*

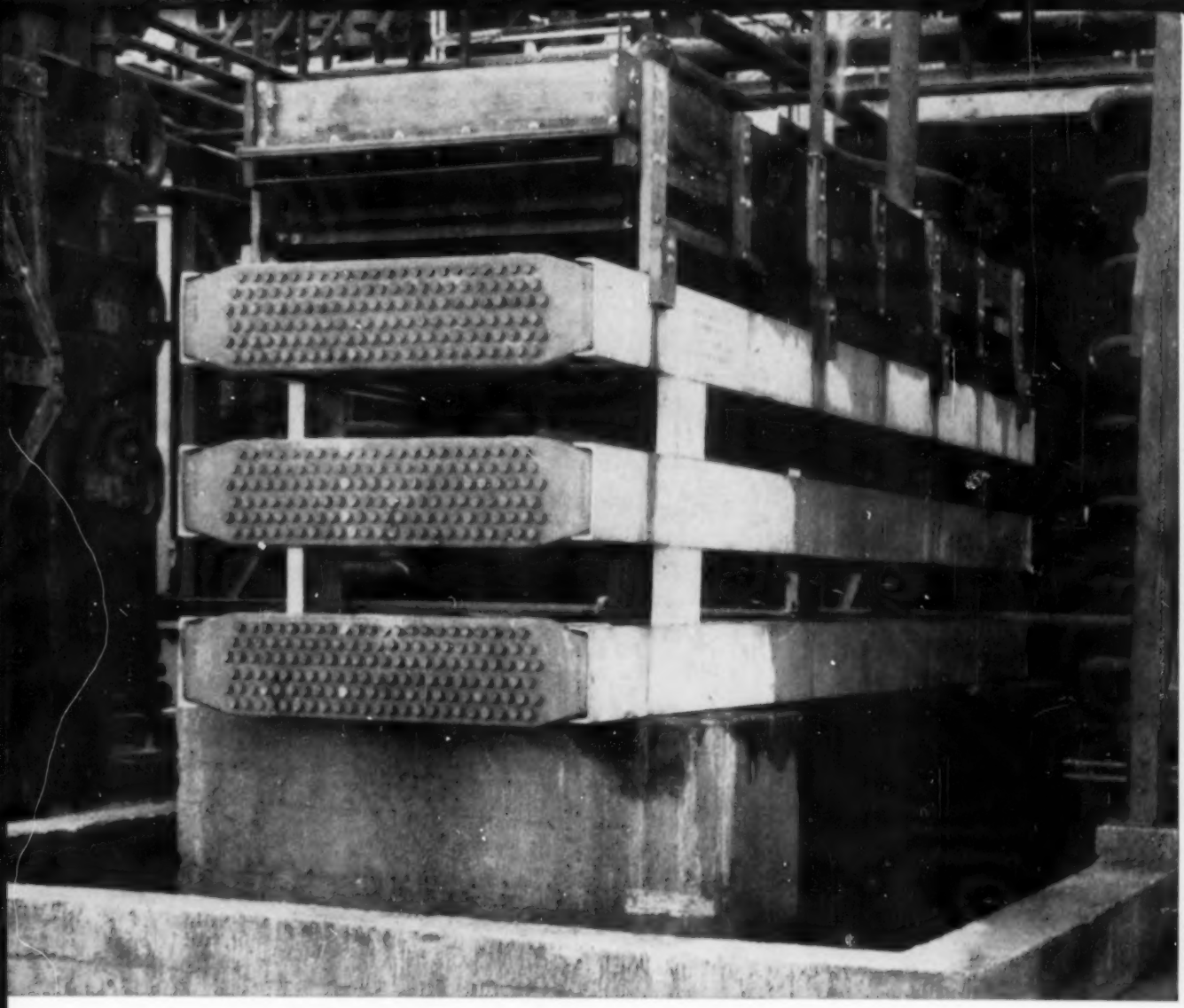


Breather Springs

. . . **permit expansion of insulation** as the process vessel or a large line heats up. They are also useful for holding insulation under conditions of strong vibration.

Made of Type 302 stainless steel, the breather springs are highly resistant to chemicals and acids while still retaining their spring characteristics and high tensile strength up to 600°F. Other corrosion resistant materials may be used for specific applications, such as K Monel or Inconel.

Since the springs are only ⅜-in. thick, they will not protrude through the insulation cover nor will they dig into the insulation material. Original application has the advantage of measuring the proper tension of the metal



less slime . . . more heat transfer with Stainless Steel tubes

Carbon steel tubes were previously used in this copper solution cooler, but they built up slime and scale rapidly. This reduced the heat transfer coefficient, and made it necessary to clean tubes frequently.

So the tubes were replaced with type 304 Stainless Steel. Cleaning has been practically eliminated. The tubes are expected to last indefinitely, and the increased heat transfer has reduced the output feed stock temperature by a good ten degrees.

Here is a Stainless Steel feature that is sometimes overlooked: the smooth, dense surface repels filth and contamination. In heat exchangers, this results in lower fuel costs and maintenance costs. As a bonus, you have the great corrosion resistance and strength that make Stainless Steel so popular in modern refineries. But be sure of service-tested quality; specify USS Stainless Steel.

UNITED STATES STEEL CORPORATION, PITTSBURGH · AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO · NATIONAL TUBE DIVISION, PITTSBURGH
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS STAINLESS STEEL

SHEETS · STRIP · PLATES · PIPE · TUBES · WIRE
BARS · BILLETS · SPECIAL SECTIONS

USS

6-1299

UNITED STATES STEEL

BS&B *Safety Heads* SOLVED THE PROBLEM!

No. 1 of a series

CASE HISTORY FILE NO. 1673

Problem:

Large producer of Natural Gasoline and LPG sought positive protection from corrosive action caused by hydrogen sulphide gas on standard safety valves installed on still column dome. Corrosion of these valves could cause them to malfunction, and result in explosion and fire.

Solution:

A BS&B Safety Head, with Kel-F lined metal rupture disc, was installed between each safety valve and the vessel it protected.

Result:

Corroded safety valves are no longer a problem for this company.

BS&B — Over 40 Years — Dependability — Another Example of Product Leadership

Have you considered what BS&B Safety Heads can do to improve the safety of **your** pressurized equipment? Complete information on the many possible applications of BS&B Safety Heads will be sent on request.

BS&B *Safety Heads*

THE "CIRCUIT-BREAKER" of Pressured Systems

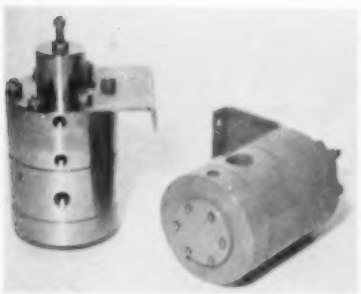
BLACK, SIVALLS & BRYSON, INC.

Safety Head Division, Dept. 2-D12

7500 East 12th Street Kansas City 26, Missouri

bands by expansion of the spring. These springs can be used with any type bands in widths of ⅜, ½ or ¾ in. **Techalloy Company, Inc.,** Rahns, Pa.

Circle No. **12** *on Reply Card*



Vaporizer Regulator

. . . **assures proper injection** of liquid samples into analyzers and other petrochemical monitoring instruments.

Designed and field-tested by Phillips Petroleum Co. for use with infrared analyzers and refractometers, it ensures that liquid samples are introduced into these types of instruments in a vaporized state and at pressures of about 15 psi. It can also be used in continuous sampling systems.

Built to operate at inlet pressures of up to 150 psi, the regulator will hold pressure constant with 0.10 psi when upstream variations do not exceed 10 psi. The outlet pressure may be adjusted from 0 to 50 psi. Heat is supplied by steam pressure at 50 psig or an electric heating element of 75 watts. **Consolidated Electrodynamics Corp.,** 300 North Sierra Madre Villa, Pasadena, Calif.

Circle No. **13** *on Reply Card*

Steam Purifier

. . . **reclaims low pressure steam** and removes oil, pipe scale and other impurities before the steam is returned to the boiler.

The model LS Hi-eF Purifier cleans the steam without moving parts, fil-

to meet exacting lubrication standards, specify

ENJAY PARANOX®

detergent-inhibitor additives

When exacting lubrication standards must be met, you can depend on the Enjay Paranox group of highest-quality additives, famous around the world, for the right detergent-inhibitor to blend with every type of base stock.

Enjay has worked extensively with oil companies and leading engine manufacturers to develop lubricating oil additive formulations for military and commercial specifications.

Let us put this experience and know-how to work for *you*. Write, wire or phone the Enjay Company—your only source of a *complete* line of additives (Paramins®) for fuels and lubricants.

ENJAY

Pioneer in Petrochemicals

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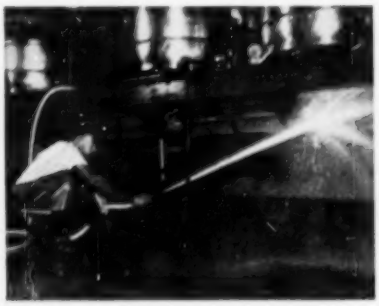
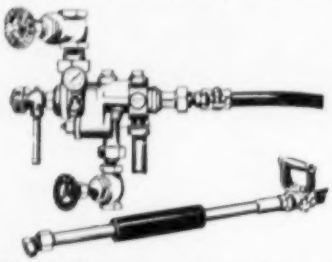


ELIMINATE DIRTY WORK

Until recently, there was no real substitute for hand scrubbing on tough cleanup jobs. Nobody liked it.

Now, scrubbing action can be provided hydraulically. It's better, faster and a thousand times cheaper than any hand method.

The Sellers Hydraulic Jet Cleaner uses only cold water and steam (as low as 5 psi.). It delivers a high temperature, high impact jet, with or



without detergents, that scrubs clean any surface. It sweeps floors, conveyors, processing machinery free of all types of foreign matter . . . cleans hard-to-reach spots without dismantling equipment.

There's no comparable cleaning action provided by any cleaning device, no matter what cost. The Sellers Hydraulic Jet is easily installed . . . simple to operate.

GET THE FACTS . . . *send for Bulletin 424.*

SELLERS *Injector* **CORPORATION**

1608 Hamilton Street, Philadelphia 30, Pa. • Since 1848

ters or mesh screens. A patented two-stage principle of separation uses carefully controlled centrifugal force to guide the entrainment-laden vapor through a series of vanes and baffles. In the first stage large droplets of entrainment are removed. In the second stage fine mist entrainment is removed by centrifugal action. The careful guidance of steam and separated material in both stages permit the design of a small unit without carryover.

The unit shown above is a 45-in. size installed in a 42-in. horizontal pipeline, operating at 42,000 lb steam per hour at 2 psia. **V. D. Anderson Company,** 1935 West 96th St., Cleveland 2, Ohio.

Circle No. **14** *on Reply Card*

Chlorine Detector

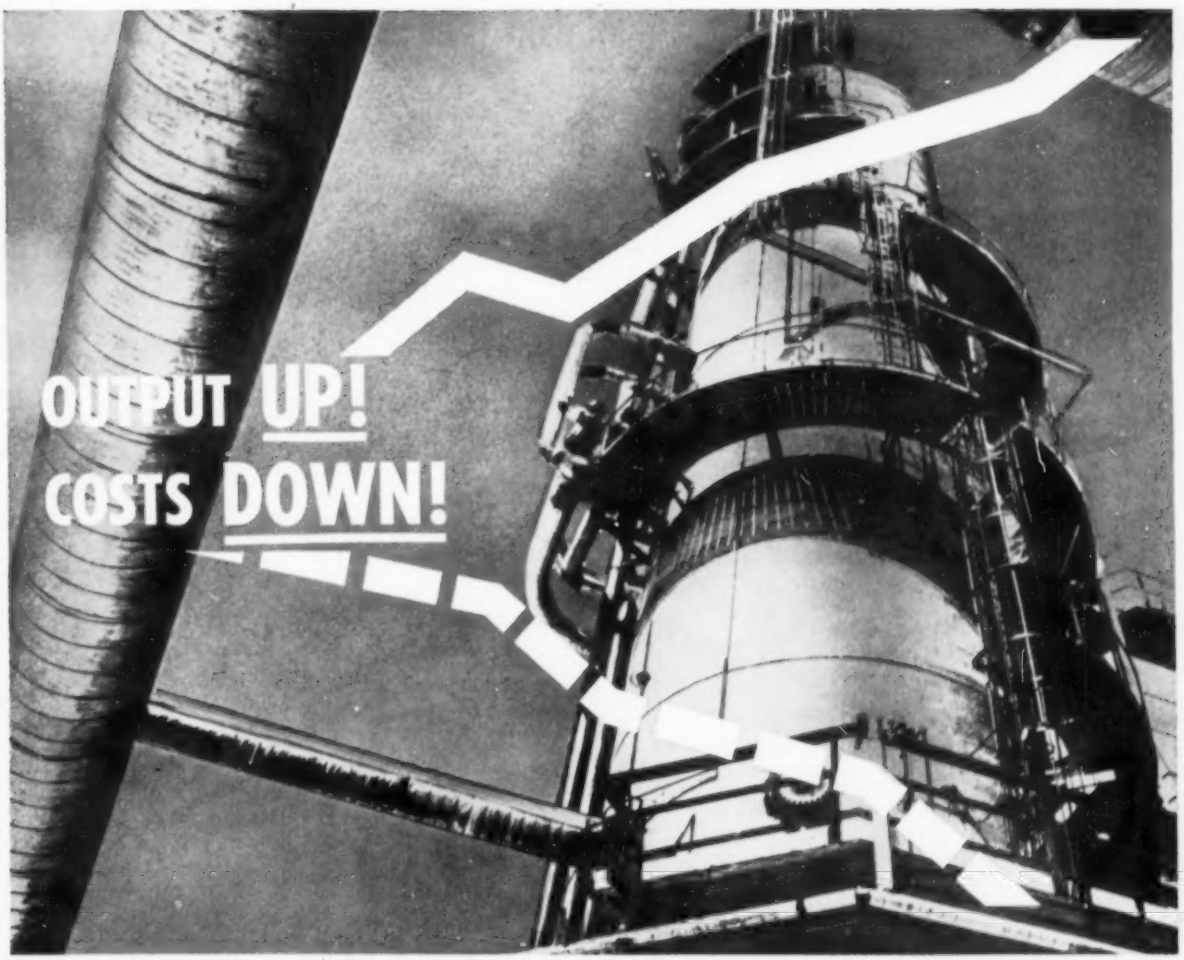
. . . **warns of concentrations exceeding 3 ppm,** and monitors suspected area air continuously.

A centrifugal blower draws air from any monitored area into the detection chamber and discharges it outside the building. If the concentration of chlorine exceeds a preselected value, an alarm signal is actuated through the reaction of chlorine gas with a chemically treated dry paper. Any chlorine in the air darkens the paper, and a light source reflects from the test paper to a photoelectric cell. When the amount of reflected light is sufficiently diminished, the alarm is energized.

The detector can be mounted at any convenient point away from the area to be monitored, provided the sum of the lengths of the inlet and discharge sampling lines does not exceed 200 ft. **Wallace & Tiernan Inc.,** 25 Main St., Belleville 9, N. J.

Circle No. **15** *on Reply Card*

(Continued on p. 126)



with METEX Hi-Thruput MIST ELIMINATORS

METEX Hi-Thruput Mist Eliminators, installed in process towers and vessels, effect sharp separation of liquids and gases. Quality and yield are increased. Valuable liquids are knocked out and returned. Contamination of subsequent processing is removed. Turbines and compressors are protected from damaging liquids. Where build-up of coke or solids is a consideration, on-stream service life is increased three to four times. Air pollution is reduced, too.

METEX Hi-Thruput Mist Eliminators provide virtually 100% removal efficiency, even at extreme temperatures and pressures. Pressure drop is negligible. Their outstanding performance is due to repositioning of the wires by the METEX patented Herringbone Fold . . . an exclusive development of the originators of knitted wire mesh entrainment separators. Impingement target area is increased and stagnation points reduced.

In any processing equipment or vessels where liquid entrainment is a contributing factor in design or operation, specify METEX Hi-Thruput Mist Eliminators to assure greater production, improved quality of yield and substantially reduced operating and maintenance costs.

For complete information and specifications, write today for your free copy of Bulletin No. ME-6.

6-201

METAL TEXTILE CORPORATION ROSELLE, NEW JERSEY

Metal Textile Corp. of Canada, Ltd., Hamilton, Ontario • Representatives in principal cities throughout the world

Unbeatable

for
fast, clean
pipe or conduit
cutting . . .

7 models
for 1/8" to 6"
pipe and conduit

efficiency-balanced
RIDGID
Heavy-Duty
Pipe Cutter

It's a tool that knows its business, that comes to your hands like an old friend. It rolls easily through any pipe or conduit, scarcely a trace of burr. Strongly built, guaranteed not to warp or break, always tracks perfectly. Thin-blade or heavy-duty cutter wheels (special wheels for stainless or cast iron). For pipe or conduit cutting that's a satisfaction, buy RIDGID's at your Supply House.

RIDGID
4-WHEEL
for easy cutting in tight places

RIDGID
Work-Saver Pipe Tools

The Ridge Tool Company, Elyria, Ohio, U. S. A.

Metering Plug Valve

. . . **has a replaceable nylon seat** for trouble-free operation. The plastic seat will withstand metering action and, unless severely damaged, will continue to give leak proof shutoff action.

A straight through, high volume passage and a non-lubricated rising stem design eliminates flow directed against the stem seat and threads. This prevents the erosion found in conventional over and under passages. The design also permits replacing the stem and bonnet in the line without breaking the connections to the valve.

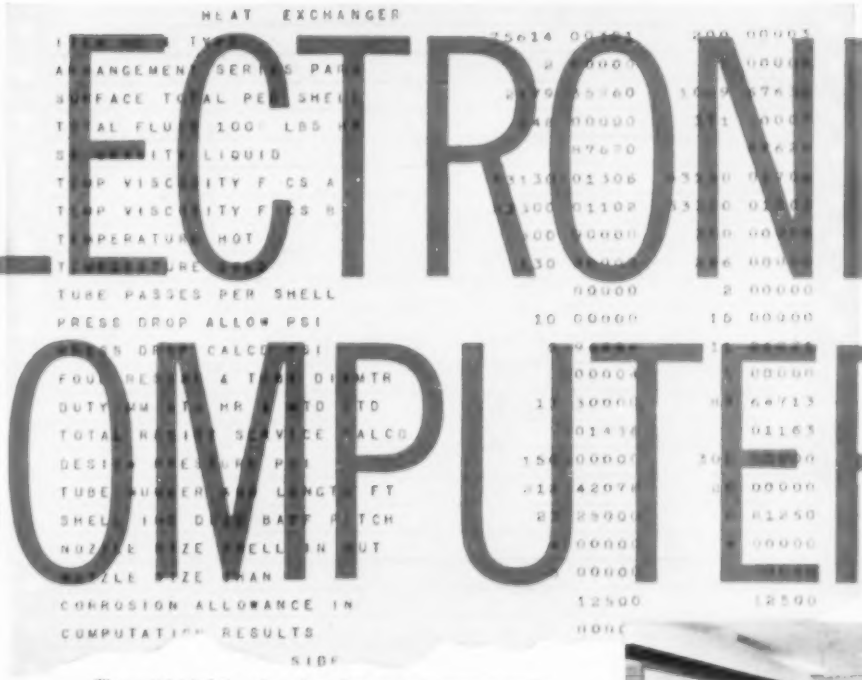
The body, bonnet and stem of the valve are made of Type 303 stainless steel; Teflon may be substituted for the nylon seat. The valve is rated at a pressure of 6,000 psig for water, oil or gas. Available sizes are ⅛, ¼, ⅜, ½, and ¾ in. **Anderson, Greenwood & Co.,** Bellaire, Texas.

Circle No. **16** *on Reply Card*

Neoprene Caps

. . . **protect expensive pipe and tubing** against corrosion during storage. These roll-on (or slip-on) caps can also protect heat exchanger tube bun-

More Precise Design Calculations with M. W. Kellogg's New, Super-Speed ELECTRONIC COMPUTER



The partial tabulation above shows how computer presents results. The computer itself is shown at the right.

The latest addition to The M. W. Kellogg Company's facilities for engineering heat-pressure process equipment is a new, large magnetic drum digital computer. It can execute 500 arithmetical operations per second; conservatively can solve 40 simultaneous equations in 30 minutes; and has a memory capacity of over 4000 ten-digit words.

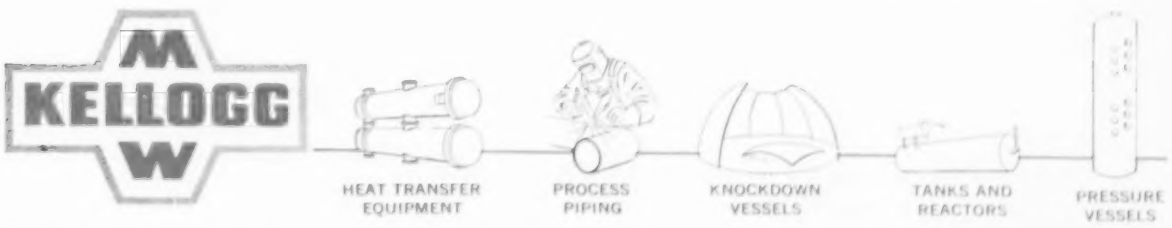
This new computer enables M. W. Kellogg's engineering staff to undertake a far greater number of precise calculations in less time than ever before and, as a result, to determine the optimum designs for customers in minimum time. For example, complete calculations for a liquid to liquid heat exchanger, which formerly took 10 to 15 hours, now can be done in about 15 minutes.

Electronic computation is an important supplement to the productivity of Kellogg's heat transfer engineers and permits them more time for evaluating results and improving designs. We welcome the opportunity to demonstrate what these aspects of Kellogg's "built-in engineer" can contribute to your requirements.

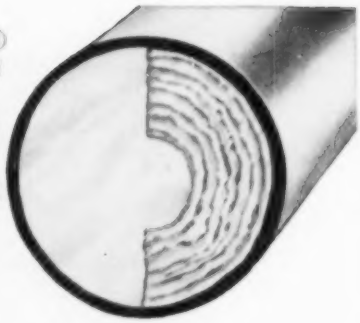
Fabricated Products Division THE M. W. KELLOGG COMPANY 711 Third Avenue, New York 17, N. Y.

A SUBSIDIARY OF PULLMAN INCORPORATED

The Canadian Kellogg Company Limited, Toronto • Kellogg International Corporation, London • Societe Kellogg, Paris
Kellogg Pan American Corporation, New York • Companhia Kellogg Brasileira, Rio de Janeiro • Compania Kellogg de Venezuela, Caracas



how
KE-TONE* ®
prevents and
removes scale



KE-TONE utilizes the best features of the polymerized phosphates and the amino acid chelates to inhibit scale formation and actually dissolve and remove scale deposits. The KE-TONE method of treating the large volumes of water used in cooling towers, boilers and other industrial installations, *loosens, fractures, suspends* and in many instances actually *dissolves* scale. Any suspended or dissolved scale may then be removed in the effluent from the system or in the blow-down. So effective are small concentrations of KE-TONE that large volumes of water may be treated with utmost economy.

Outline your scale problem and send for Technical Bulletin on KE-TONE today.

*Patented

KE-TONE — "Makes Water Work"

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OF NEW MEXICO, HOBBS, NEW MEXICO

CATAWISSA VALVE & FITTINGS CO.
CATAWISSA • PENNSYLVANIA

dles and other tubular goods during turnarounds.

By adding a small amount of dehydrating agent before slipping on the easily fitted caps, the inside of the tube stock can be protected during long periods of storage. The same caps can be used for the protection of threaded pipe ends by retarding drying of thread dope and keeping sand and grit away from the threads. Because the caps are made of neoprene, they will withstand rough handling and repeated use. They are also highly resistant to oil, acids and other chemicals, sunlight, and weather.

Two types are currently available: a lightweight roll-on cap for pipe 2 to 10 in. in diameter; and a heavier, slip-on cap for 2 to 20 in. diameter piping. The standard slip-on covers have a wall thickness of about ⅛ in. **Protokap, Inc.,** 625 West Building, Houston, Texas.

Circle No. **17** *on Reply Card*

Water Fire Extinguisher

. . . **is powered by compressed air,** permitting the operator to turn off or on the water at will.

No bouncing or inverting is needed to activate this extinguisher. The stream of water is released by operating the squeeze grip, which also serves as a carrying handle. Effective range of the water stream is 35-40 ft.

For cold weather, anti-freeze will permit operation of the extinguisher down to —40°F. After use, the extinguisher can be recharged by re-

All oilmen make this big sale possible! Americans bought 7,169,908 new cars last year, filled 'em up with gasoline and oil and set out for fun or business. The ready availability of gas and oil helps close every car sale, keeps the auto industry moving. In fact, we oilmen—from drillers to pipeline men—help keep millions working at everything from agriculture to zoology. When you hear someone who doesn't know the facts criticize our industry, speak up. Tell how oil helps keep our strong economy rolling in high gear. Be proud you're an oilman. And tell the world! **SHELL OIL COMPANY**

OXYGEN

key to modern industrial processes

Control it with...

Arnold O. Beckman INC.

OXYGEN ANALYZERS!

Oxygen is one of the most important factors found in modern chemical and industrial processes. Whether to minimize product oxidation (prepared atmospheres, air infiltration, etc.) . . . or to insure adequate oxygen for efficient combustion (boilers, kilns, etc.) . . . or to control oxygen for proper process operations (ammonia, acetylene, air fractionation, etc.) oxygen control has become too important in today's operations for any profit-minded executive to overlook.

And because they are the *only* instruments that measure oxygen content directly, accurately and conveniently, Arnold O. Beckman Oxygen Analyzers have become the leading instruments for modern oxygen control in a wide range of applications – from catalytic refineries to cement kilns – from power plants to personnel protection.

These instruments (and systems) can be built to meet *your individual* needs.

These instruments offer many unique advantages . . .

SELECTIVITY: Highly sensitive to oxygen. Effects of gases other than oxygen are negligible.

HIGH ACCURACY: 1% of full scale (Example: ±0.05% O_2 on range 0-5% O_2).

MANY RANGES: Full scale ranges from 0-1000 ppm or up to 0-100% O_2 available. Combustion ranges 0-5, 0-10, 0-15% O_2 supplied with 0-25% O_2 check range. Multi-range instruments available.

RAPID RESPONSE: Standard Analyzers – 95% response in less than 1 minute. Special Units – 95% response in 7 seconds!

USE ANY RECORDER: Millivolt output for potentiometers; current output for miniature electronic recorders and galvonometers; air output for pneumatic receivers and control systems.

PACKAGE UNITS: Analyzers and controls may be built into a cubicle with sampling components wired, piped, and ready for installation as a single unit.

SAMPLING SYSTEMS: Complete standard systems – components, package or portable units are available.

OTHER ADVANTAGES: Instruments may be mounted in explosion-proof cases, mounted indoors or outdoors, in portable panels, and have other desired features.

Model F3: Ranges of 0-1%, 0-5%, 0-10%, and higher. Meter on door for convenient readings at sampling point.

Model G2: Full scale ranges 0-0.1%, 0-0.5%, and others for low O_2 content. Ranges 90-100%, 95-100% O_2 for high O_2 content.

The above are but two of the complete line of Arnold O. Beckman Oxygen Analyzers available for every requirement.

Send for helpful free literature which describes Arnold O. Beckman instruments in detail. When writing, outline your particular application – we'll gladly supply specific information.

Data File 201-126

Arnold O. Beckman INC.

ANALYZERS

Profit Builders for Industry

1020 Mission Street

South Pasadena, California

placing the water (and anti-freeze) and pressurizing the unit to 100 psi at any source of compressed air. A tri-color gauge tells at a glance whether the air pressure is adequate to discharge the unit effectively. **Ansul Chemical Co.,** Marinette, Wis.

Circle No. **18** *on Reply Card*

Copper Deactivator

. . . **will not freeze at** temperatures of 0°F, and is designed to eliminate the problems encountered in low temperature pumping.

Since traces of copper (usually less than 1 ppm) are often found in gasolines, they must be removed to prevent a strong catalytic effect on the oxidation, gum formation and tetraethyl lead decomposition. A copper deactivator will react with such small traces and destroy their catalytic activity.

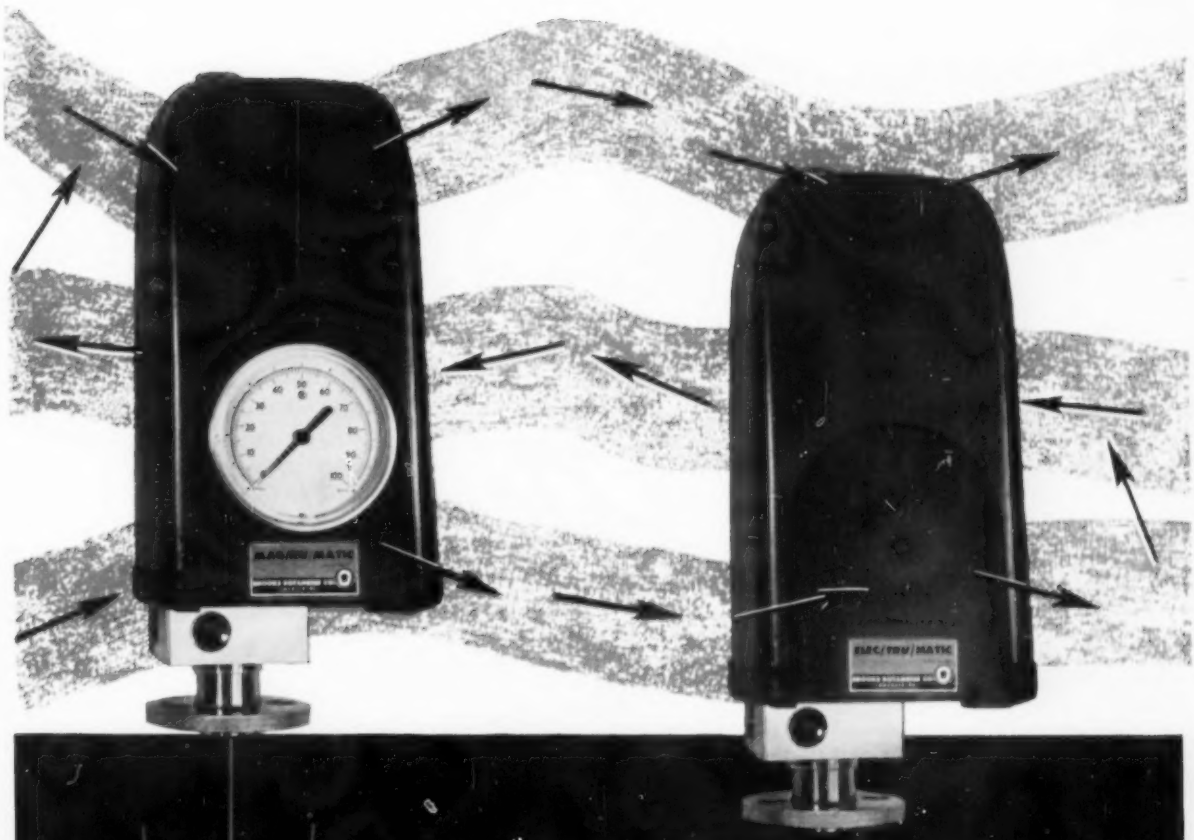
This new formulation, called UOP Copper Deactivator-AW (50), contains UOP's regular active ingredient in a 50% concentration. It can be injected directly into gasoline or other refinery streams without dilution with aromatic solvents. **Universal Oil Products Co.,** 30 Algonquin Road, Des Plaines, Ill.

Circle No. **19** *on Reply Card*

Microfilm Reader

. . . **also makes large prints** by projecting the film image onto photocopying paper.

Known as "The Examiner," the new unit uses a filing system which mounts the individual frames of microfilm in standard file cards or punched cards. When inserted into the machine, the picture may be viewed on a 14 x 14-in. screen or photo-



A NEW IDEA

in remote flow transmission

the BROOKS *TransiTwins*

are convertible ... electric or pneumatic

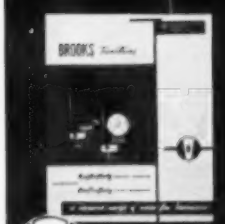
Never before such flexibility . . . such performance. The new Brooks *TransiTWINS* are one basic flow transmitter design in two forms; fulfilling your present *and* future requirements. The Mag/Nu/Matic is a force-balance pneumatic flow transmitter; the Elec/Tru/Matic is electrical. Now, you can switch one internal assembly to interchange electric or pneumatic units . . . for use with any existing receiver. The *TransiTWINS* are interchangeable with Mag/Na/Vue indicators, too, without change of float or float extension, without taking the meter from the line . . . in the biggest step ever taken toward standardized flow instrumentation.

To your technical sense, the high-resolution, transmission accuracy of the *TransiTWINS* will be an eye-opener.

To your practical sense, the maintenance simplicity of this rugged instrument line will be amazing.

If you *can* wait, send for Bulletin 170.

If you *can't*, telephone your nearby Brooks representative.

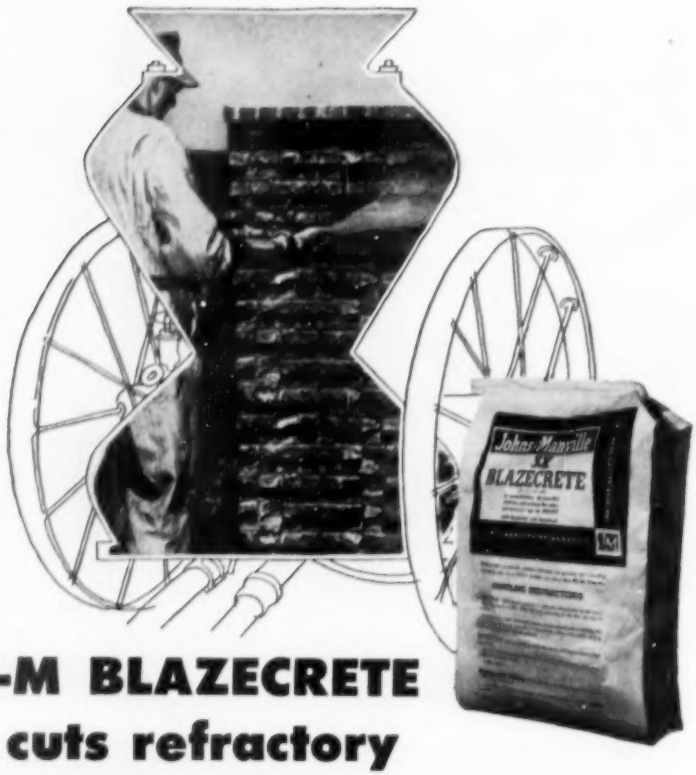


Send for Bulletin 170.

BROOKS ROTAMETER COMPANY

187 EIGHTH STREET, LANSDALE, PA

Brooks, TransiTwins, Mag/Nu/Matic, Elec/Tru/Matic and Mag/Na/Vue are trade-names of the Brooks Rotameter Co.



J-M BLAZECRETE cuts refractory maintenance costs...

That's why it pays you to use this hydraulic-setting refractory for temperatures to 3000F

Blazecrete* materially reduces labor costs for refractory maintenance. This hydraulic-setting refractory saves time in building and repairing linings for high-temperature equipment.

For troweling, just mix Blazecrete with water as you'd mix ordinary concrete . . . then slap-trowel it in place. When gunned, it adheres readily with a minimum of rebound loss. Either way, Blazecrete goes on fast, without laborious ramming or tamping. And Blazecrete linings *last*.

Three types of hydraulic-setting Blazecrete are available. All harden on air curing, do not require prefiring. They are furnished as a dry mix—can be stored safely for use as needed.

3X BLAZECRETE—For temperatures through 3000F. Unusually effective for heavy patching, especially where brickwork is spalled or deeply eroded. Excellent for forge furnace linings, lime kilns, burner blocks, soaking pits, and industrial boilers.

STANDARD BLAZECRETE—For temperatures through 2400F. Makes repair work easier and less costly. Can be used by boiler manufacturers to replace fire clay tile in wall construction. Suitable for use in combination with 3X Blazecrete and L. W. Blazecrete.

L. W. BLAZECRETE—For temperatures through 2000F. An insulating refractory . . . light in weight, low in thermal conductivity. Adaptable and economical for many other applications.

Send for Brochure RC-28A on Blazecrete and its companion material, Firecrete*. . . the hydraulic-setting castable refractory for making special shapes and linings. Write Johns-Manville, Box 14, New York 16, N. Y. In Canada, 199 Bay St., Toronto 1, Ontario.

*Reg. U.S. Pat. Off.

Whether you gun it... *or slap-trowel it...*

Johns-Manville **BLAZECRETE**

BUILDS BETTER REFRACTORY LININGS

copied. Interchangeable lenses permit magnification of from 15 to 42 times greater than the microfilm. **Filmsort Division, Dexter Folder Co.,** Pearl River, N. Y.

Circle No. **20** *on Reply Card*

Rupture Disc

. . . **for tank car safety vent** ruptures at 45 psi but will not corrode. A Teflon seal resistant to most chemicals, provides the pressure seal for the rupture disc assembly. It isolates the inconel rupture disc from the contents of the tank car.

The Model TC rupture disc requires no special fittings and can be installed in either the threaded or bolted tank vents normally supplied on tank cars. In case of pressures above 45 psi maximum, the frangible disc of inconel will rupture and relieve excessive tank pressures. A vacuum support is built into the disc assembly to prevent its collapse during vacuum conditions. **Black, Sivalls & Bryson, Inc.,** Kansas City, Mo.

Circle No. **21** *on Reply Card*

Free Trade Literature

Dry Grinding Mills

. . . for pulverizing solid lump material to micron sizes: *Bulletin No. 17-C* is a 44-page discussion of the many available types of mills—conical, cascade, rod, tube, disc roll and many others. Included in the bulletin is a chapter on selecting the right mill for various materials. Flow sheets for several typical installations are also included. Hardinge Co., Inc., 240 Arch St., York, Pa.

Circle No. **22** *on Reply Card*

Glassed-Steel Columns

. . . and the construction of special alloy columns: *Bulletin No. 940* tells why glassed-steel and alloy columns are advisable for corrosive processes. Given are the dimensions and operating characteristics of these packed or

use steam efficiently, economically—choose the trap with . . .

just one moving part

. . . for easy maintenance

After all, a steam trap *should* be simple. Its job of discharging condensate and air from steam lines and equipment, is a simple one. But its importance shouldn't be overlooked. On its effectiveness can rest your economical use of steam . . . the efficiency of your process operations.

With Nicholson steam traps there's just one moving part. Nothing to go wrong. But with all their simplicity, Nicholson traps have the greatest capacity of any trap their size. Plenty of other important features, too, and it'll be well worth your while to check them.

- **Powerful valve action**
- **Tight, positive shutoff**
- **No dribbling, no steam waste**
- **Each unit service tested**

Specify Nicholson, and be sure.

Write today for new Bulletin 10-55

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W. H. NICHOLSON and Company

TRAPS • VALVES • FLOATS • METAL PARTITIONS
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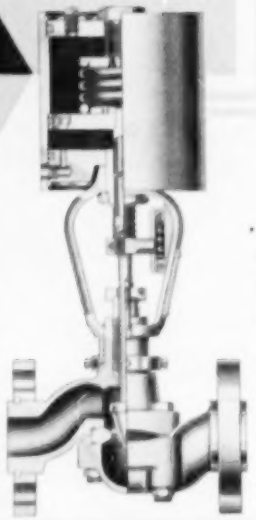
For Remote Shut-off Applications...

ANNIN
CYLINDER VALVES

provide the complete answer!

absolute shut-off dependability and safety with **ANNICO TEFSEAL SEATS** proven in dangerous services, such as Liquid Oxygen, Fuming Nitric Acid, Liquid Nitrogen and CO_2, Fuels and other FLUIDS at all pressures and temperatures $-300°$ to $+450°$ F.



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3-WAY OR 4-WAY MANUAL AIR ACTUATED

PNEUMATIC CONTROLLER ACTUATED

...with these advantages:

- Positive shut-off
- Fast action
- Spring to open
  or
- Spring to close
- Globe, angle & 3-way bodies
- Carbon steel and all cast and forged alloys available
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THE ANNIN COMPANY

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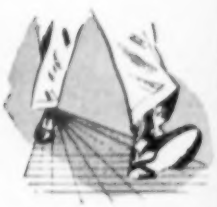
WHERE SURE FOOTEDNESS COUNTS



Gary

STEEL GRATING MAKES WALKS SAFER

Sturdy, one-piece construction with tops of all bars flush provides open steel flooring and stairs for safe, easier walking. Gary Grating is furnished in a wide variety of neat appearing designs and sizes—and is tailor-made to fit your needs. For complete description and installation pictures on Gary Welded Grating, Stair Treads and Gary-Irving Decking, ask for Catalog PP-126.

FREE SAMPLE

We'll send this handy paper weight if you request it on your company stationery.

Standard Steel Spring Division

ROCKWELL SPRING AND AXLE CO.

4016 East Seventh Avenue • Gary, Indiana

tray-type columns, applicable for fractionation, stripping, absorption, extraction and chemical reactions. The Pfaudler Co., Rochester 3, N.Y.

Circle No. **23** *on Reply Card*

Pipeline Projects

. . . designed for the oil and gas industry: *Bulletin No. 1704* is a 20-page brochure describing many pumping and compressor stations for pipeline operation that have been engineered by this company. Included in the booklet is a section describing the facilities of its fabrication shop. Dravo Corporation, Machinery Division, Fifth and Liberty Ave., Pittsburgh 22, Pa.

Circle No. **24** *on Reply Card*

Nitric Acid Plants

. . . for low-cost production: *Bulletin #101-3M-456* describes typical operating requirements and process for making low-cost nitric acid by the catalytic oxidation of ammonia with air. This process developed by Du Pont uses only three raw materials—ammonia, air and distilled water. The Fluor Corporation Ltd., Box 7030, East L.A. Branch, Los Angeles 22, Calif.

Circle No. **25** *on Reply Card*

Catalysts

. . . for hydrogen treating: a technical bulletin describes in detail a cobalt molybdenum catalyst for upgrading a wide molecular weight range of petroleum stocks. General reactions are listed and described. And typical flow diagrams and reactions in hydrogen treating petroleum feed stocks over this catalyst are included. The Girdler Co., 224 East Broadway, Louisville 1, Ky.

Circle No. **26** *on Reply Card*

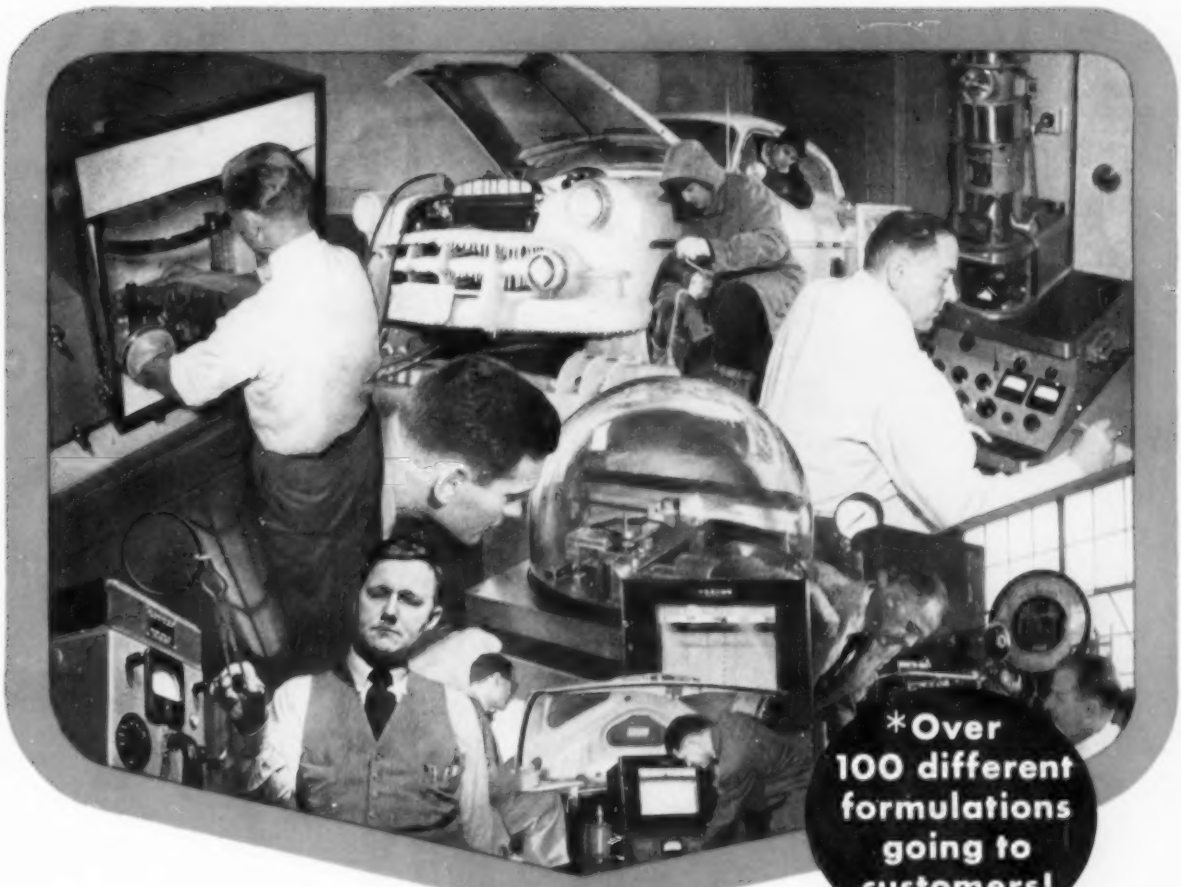
Jet Vacuum Pumps

. . . and boosters for low suction pressures: *Bulletin 5H3* describes both condensing and non-condensing types. Sizes and dimensions of three, four, and five stage jet pumps are given in a quick-reference tabular form. Performance characteristics for three-stage units are included. Schutte and Koerting Co., Cornwells Heights, Bucks County, Pa.

Circle No. **27** *on Reply Card*

Pneumatic Controllers

. . . for the automatic control of many process conditions: *Bulletin A130* is a 44-page catalog of all types of pneumatic control instruments—strip-chart, round-chart, indicating and recording



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the leading source for custom-formulated* lube oil additives

As proof of formulating to a customer's exact price and performance specifications, Oronite has compounded and engine tested hundreds of additive compounds—is currently supplying over a hundred different formulations.

Whether you wish "complete-performance" additives or "single-performance" ingredients in an additive, you will find Oronite willing and able to meet your requirements.

Having close association with marketing departments of major oil companies, Oronite is familiar with the opportunities of the oil marketer. Why not talk it over with an Oronite lube oil additive specialist. Just contact the Oronite office nearest you.

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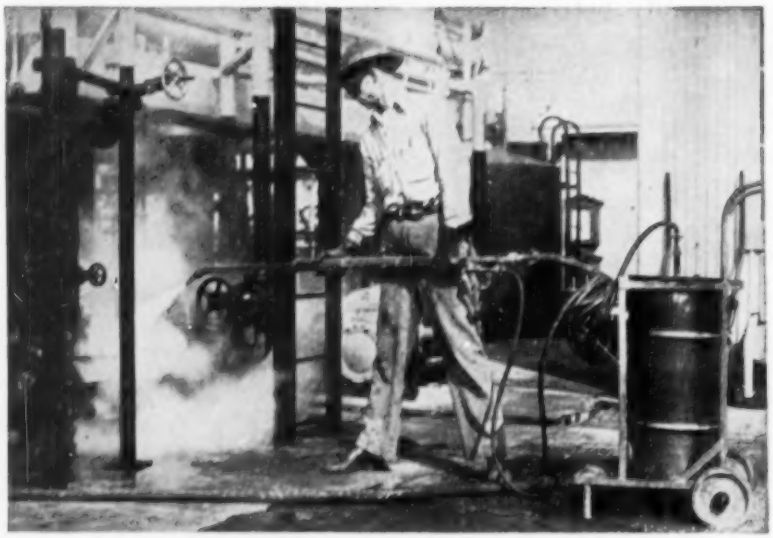
36 Avenue William-Favre, Geneva, Switzerland



How One Man and a Gun did Two-Weeks work—in a Day!

Oakite Steam-Detergent Gun makes short work of maintenance cleaning for one refinery

The cleaning problem facing one California refinery seemed simple enough. All it involved was removing accumulations of dirt, grease, and muck from tanks, pumps and similar equipment. But when the time required was considered, the job assumed major proportions. It meant tedious scraping, wire-brushing and wiping. It involved struggling with hard-to-get-at surfaces. And it meant utilizing a whole crew for hours of unproductive labor. Could the Oakite Man suggest a faster way?

He could – and he did. He suggested using specialized Oakite detergents – and applying them with the Oakite 384 Steam-Detergent Gun. Light-weight and easy to handle, this versatile cleaning tool enables one man to direct a power-packed jet of heat, detergency and steam at soiled areas and literally blast away grease, grime and soil deposits. The plant superintendent agreed to give it a try.

By that afternoon, he reported that the Oakite Steam-Detergent Gun had enabled one man to do about two weeks work in a single day!

Proving that – it pays to consult Oakite for every cleaning need.

FREE BOOKLET: Like more information about Oakite's modern cleaning methods and materials? Free booklet contains helpful information on drum reconditioning, descaling, salvage cleaning, paint stripping and many other important refinery cleaning chores. For your copy, write Oakite Products, Inc., 52E Rector Street, New York 6, N. Y.

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS · METHODS · SERVICE
SCIENCE

Export Division
Cable Address: Oakite

Technical Service Representatives in Principal Cities of U. S. and Canada

controller. Included also are descriptions of accessories for measuring temperature, pressure, humidity, flow, density and specific gravity, level and pH. The Bristol Co., Waterbury 20, Conn.

Circle No. **28** *on Reply Card*

Organic Chemicals

. . . and their applications and physical properties: *Booklet F-6136* is a 24-page publication that describes more than 335 organic chemicals made by this company. Featured are 21 new products. All information is arranged by the family group of the chemicals, and an alphabetical index assists quick finding of information. Carbide and Carbon Chemicals Co., 30 East 42nd St., New York 17, N.Y.

Circle No. **29** *on Reply Card*

Precision Fitting

. . . of bearings, valve seats and pistons: *Precision Finish* is a 24-page booklet describing the techniques of lapping final fittings on many types of machinery and equipment. One section of the booklet is an instruction sheet for specific applications—round bearings, gear lapping, worm gear lapping and slides and ways. Timesaver Products Co., 629 W. Washington Blvd., Chicago 6, Ill.

Circle No. **30** *on Reply Card*

Pipe Corrosion

. . . and how to prevent it with insulating tape: *Tape It Easy*, a 24-page booklet, provides a step-by-step instruction for wrapping bends, elbows and short sections of underground piping. Additional "how-to" information is supplied for preparing joint surfaces for wrapping, patching pipe with tape and wrapping of special fittings. Minnesota Mining and Manufacturing Co., Dept D6-262, 900 Fauquier St., St. Paul, Minn.

Circle No. **31** *on Reply Card*

Diaphragm Valves

. . . for positive control: *Catalog #100* describes the construction and operation data for this type of shutoff valve. Available in sizes ranging from ¼ to 14 inches, the valve is made for normal and corrosive conditions. Bodies may be made from cast iron, alloys, aluminum or plastics. The diaphragms are constructed from polyethylene, Teflon or Kel-F. Hills-McCanna Co., 3025 N. Western Ave., Chicago 19, Ill.

Circle No. **32** *on Reply Card*

(Continued on p. 138)

Steelwork Goes Up Quickly With High-Strength Bolting

Erection of steelwork for cracking towers and other types of refinery structures proceeds at a rapid pace when you use Bethlehem High-Strength Bolts to connect the structural members.

With Bethlehem High-Strength Bolts you get field connections that stay tight, even when subjected to vibration. The bolts are used in place of rivets, and are combined with two hardened washers, one placed under the hexagonal head, the other under the hexagonal nut. The nut is tightened with a pneumatic impact wrench, resulting in high clamping pressure.

Bethlehem High-Strength Bolts are economical because they can be installed by two men, one using a holding wrench, the other an impact wrench. The bolts are made from carbon steel, and meet the requirements of ASTM Specification A-325. They are carried in stock in a complete range of sizes.

If you have expansion plans in mind, we suggest that you discuss high-strength bolting with one of our representatives. The nearest Bethlehem sales office will be glad to hear from you at any time.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

BEFORE YOU BUY ANY STEAM TRAP...

LOOK INSIDE THE CASE!

YOU'LL FIND FIVE ECONOMY FEATURES EXCLUSIVE WITH SUPER-SILVERTOPS

GUIDED BUCKET. Inverted bucket is guided on a patented center-tube. Results in longer life as bucket cannot become damaged. Guarantees positive leakproof seating of valve.

EASIER INSTALLATION. Only Super-Silvertops can be installed straight in line or as an elbow in any size. Conventional bottom-inlet traps require more fittings and longer installation time.

ECONOMICAL SERVICING. Instead of removing trap from a pipe-line, you can open and service a Super-Silvertop in the line, since all connections are in the head.

SUPERIOR DESIGN. Super-Silvertops have simplified piping without thin-walled passages. Other traps have built-in piping which results in narrow, hard-to-clean passages that cause gaskets to blow.

ANDERLOY VALVE AND SEATS. Developed by Anderson to combat the erosive effect of steam. Eliminates replacement of valve and seat assemblies.

THE NEW WAY Notice the simplicity and saving in fittings.

THE OLD WAY Notice how bottom inlet requires complicated piping.

FREE TRAP SELECTOR BOOKLET!
Tells how to select and install traps for all steam equipment. For your free copy, fill out and mail this coupon to:

THE V. D. ANDERSON COMPANY
Division of International Basic Economy Corporation
1931 W. 96th Street, Cleveland 2, Ohio

Name _____
Company _____
Address _____
City _____ State _____

ANDERSON
SUPER-SILVERTOP STEAM TRAPS
The Engineered Steam Traps

What's New

Prefabricated Piping

. . . for insulated systems: *Form No. 100-756* describes the prefabricated insulated piping systems that can be supplied for steam, condensate, hot or chilled water, and other fluids. Information is given on the design, applications and installations of these systems, as well as design requirements. E. B. Kaiser Co., 2114 W. Lake Ave., Glenview, Ill.

Circle No. **33** *on Reply Card*

Plastic Pipe

. . . valves and fittings: *Bulletin 10M-9.56 on Van-Cor* gives information on this brand of polyvinyl piping. Two types are available: Van-Cor is the normal impact type and Van-Cor 2 the high impact. Contents of the 16-page engineering catalog include physical properties, chemical resistance tables, dimensions, flow rate charts, and tips on assembly. Colonial Plastics Mfg. Co., 2685 East 79th St., Cleveland 4, Ohio.

Circle No. **34** *on Reply Card*

Heat Exchanger Tubes

. . . and their selection: *Technical Publication D-10* is a 52-page manual designed to present the problems of corrosion found in heat exchangers and condensers, and assist engineers in selection of the right alloy to combat corrosion. Included are helpful tables that offer estimating data—wall thicknesses, weights, cross-sectional area, external surface, etc. Chase Brass & Copper Co., Inc., Waterbury, Conn.

Circle No. **35** *on Reply Card*

Research Bulletin

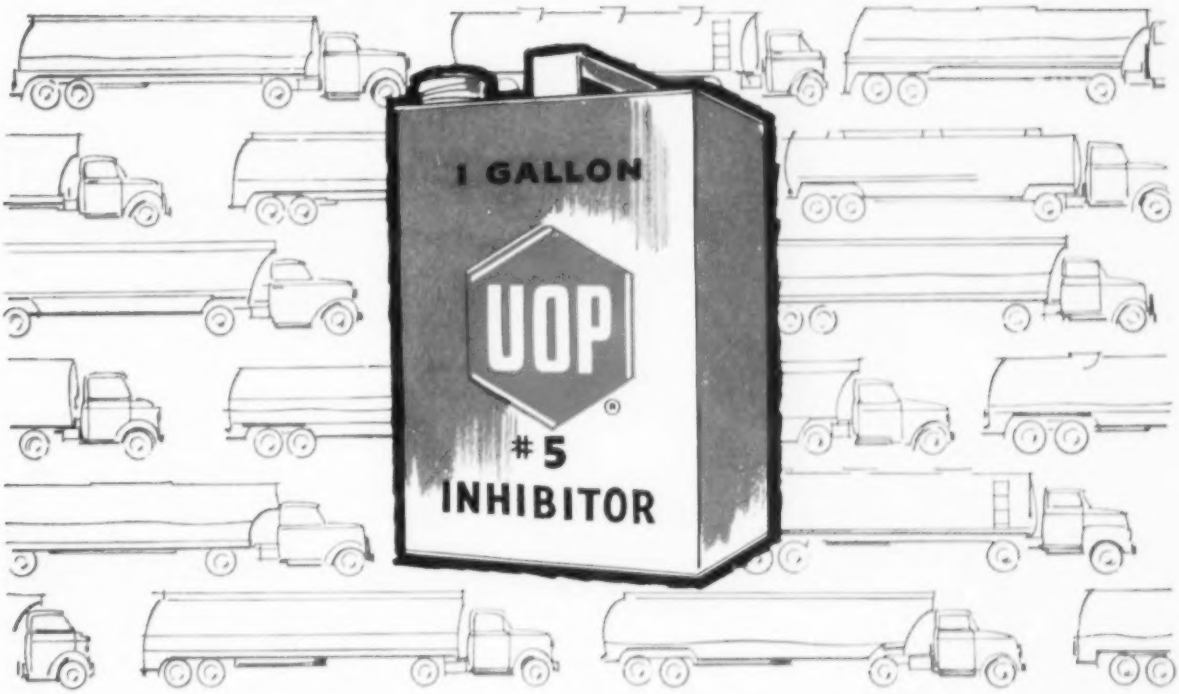
. . . describes the facilities of the Allis-Chalmers central research laboratory: *Research at Allis-Chalmers, Bulletin 48 B 8448*, is a 24-page booklet covering the complete facilities of this company's lab for developing and improving their products. Pictures and descriptions cover electrical, mechanical, nuclear, chemical, metallurgical and physical departments. Allis-Chalmers Manufacturing Co., Milwaukee 1, Wis.

Circle No. **36** *on Reply Card*

Oxygen Removal

. . . from boiler feedwater: *Bulletin AD-1010-556* tells the story of *Scav-Ox*, a 35% hydrazine solution that removes oxygen without adding any dissolved solids. It can be safely handled and requires precautions similar to caustic soda. The properties of the material and recommended dosages

IT TAKES ONLY ONE GALLON OF UOP #5...



TO KEEP 100,000 GALLONS OF GASOLINE GUM-FREE

UOP #5 Inhibitor is the most economical you can use. And by experience and test it is also the best—the only inhibitor that can handle the really tough stability jobs.

Actually, only 5 molecules of UOP #5 will protect as many as 1,000,000 molecules of today's tailor-made gasoline from the formation of gum, the one universally recognized cause of engine manifold deposits. It's effective, too, in preventing the decomposition of TEL in stored gasoline. Is it any wonder that UOP #5 is the standard of comparison in the industry?

Just as the methods of making better gasoline keep changing, so do the techniques of finishing gasoline for maximum gum stability and engine cleanliness. We will be glad to share our experience in this field with you in attacking a current stability problem or in reducing costs on present processing. Just write us.

PRODUCTS DEPARTMENT

UNIVERSAL OIL PRODUCTS COMPANY

30 ALGONQUIN ROAD, DES PLAINES, ILLINOIS, U. S. A.

(To obtain more data on advertised products see page 114)

For *Complete* Dependability

Choose From T-E's *Complete* Line of

THERMOCOUPLE ASSEMBLIES

At Thermo Electric you'll find everything for your temperature measuring needs—sensing elements, instruments and accessories. T-E's thermocouples are a good example. There's one for *every* application, *every* operating condition. And each T-E thermocouple is manufactured under close control to exacting standards. They're available in Iron-Constantan, Copper-Constantan, Chromel-Alumel and Platinum-Rhodium-Platinum.

Heavy Duty Thermocouples—wire and tubular—provide the rugged construction needed for severe conditions, while retaining sensitive performance.

Protection Tubes (Thermo-Wells)—bar stock or built-up, straight or tapered, with threaded, flanged or ground-joint mountings—are available in all commercial materials for all applications.

Miniature Thermocouples are made in a wide variety of types and sizes for any installation requiring a small-size yet sensitive assembly.

Accessories include a complete selection of connection heads, fittings, terminals, quick-coupling connectors and extension wires.

Thermo Electric Co., Inc.

SADDLE BROOK, NEW JERSEY

In Canada — THERMO ELECTRIC (Canada) Ltd., Brampton, Ontario

are included in the 16-page booklet. Olin Mathieson Chemical Corp., 460 Park Ave., New York 22, N.Y.

Circle No. **37** *on Reply Card*

Tube Tools

. . . for expanding and cutting tubes for boilers, exchangers, condensers and oil stills: *Catalog No. 81* is a 32-page presentation of specifications on the entire line of cutters, expanders and accessory tools made by this company. Gustav Wiedeke Co., 1833 Richard St., Dayton 1, Ohio.

Circle No. **38** *on Reply Card*

Caustic Soda Manual

. . . is a complete bulletin on this material: *Technical Service Bulletin 102* is a 40-page manual that includes large detailed diagrams complete with instructions for unloading and handling; a discussion of proper material in design; many charts and tables on physical properties; and a section on safety. Hooker Electrochemical Co., Box 344, Niagara Falls, N.Y.

Circle No. **39** *on Reply Card*

Heat Exchanger Catalog

. . . contains design information, as well as capacity and dimension data: *Catalog No. 1156* includes a section on the selection of type R and W exchangers for many plant uses. Also in the catalog is a oil viscosity chart for SAE oils from 10 to 60, with values in both Saybolt Universal and kinematic viscosity. Young Radiator Co., Racine, Wis.

Circle No. **40** *on Reply Card*

Non-Sparking Hand Tools

. . . report by API committee describes its finding on the use of special tools for refinery use: *Sparks From Hand Tools* is a short report that gives the reasons for the Central Committee on Accident and Fire Protection findings that ". . . for oil and gas operations no significant increases in fire safety will result from the use of so-called 'non-sparking' hand tools in lieu of ordinary tools made of steel." Department of Safety, American Petroleum Institute, 50 West 50th St., New York 20, N.Y.

Circle No. **41** *on Reply Card*

X-Ray Chart

. . . shows the characteristic secondary X-ray beams for elements from Magnesium (atomic number 12) to Californium (atomic number 98). This new spectographic chart measures 18x

From Regina to Saudi Arabia

B-L VESSEL LININGS SET RECORD AFTER RECORD FOR DEPENDABLE PERFORMANCE

It looks like a Cook's Tour—but it isn't. Instead it's a listing of recent Bigelow-Liptak refinery installations in far-flung corners of the world.

There are good, solid reasons for this world-wide preference for Bigelow-Liptak jobs. In the first place from B-L's years of experience has come a complete castable package. Insulating- and abrasion-resistant castables are engineered, furnished and installed by the same company—which means just one contract and one responsibility.

The overall result of this all-in-one engineering is exceptional durability and performance. B-L refractory installations have established world records for continuous operation. For example, after initial runs of 785 and 610 days, B-L linings were in perfect shape—required no repairs during shutdowns.

Yes, from Regina to Saudi Arabia—and points in between—Bigelow-Liptak installations are setting new records for service and performance. For complete information write for the B-L catalog "One Source". Do it today!

A FEW OF OUR RECENT JOBS

Montreal, Canada	Regenerator
Regina, Canada	Regenerator and Cyclones
Batangas, Philippines	Regenerator and Cyclones
Yokohama, Japan	Regenerator and Cyclones
Ras Tanura, Saudi Arabia	Regenerator—Reactor
Copenhagen, Denmark	Kiln Reactor
Antwerp, Belgium	Kiln
Norco, La.	Regenerator and Cyclones
Altona, Australia	Reactors
Mandan, North Dakota	Regenerator and Cyclones
Anacortes, Washington, U. S. A.	Regenerator, Reactor, Cyclones and Lines.

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and Now!—CARTAGENA, COLOMBIA

All of the castable refractories required for a complete cat cracker—including a regenerator and reactor and the interconnecting lines—will be furnished by Bigelow-Liptak for a job now going up at Cartagena, Colombia. In addition, B-L will furnish erection help and supervision.

22 inches, suitable for wall display. K Alpha and K Beta lines are shown for the following analyzing crystals: EDDT, ADP, Topaz, Lithium Fluoride and Rock Salt. Horizontal scales show Two Theta Angles in degrees and Wavelengths in Angstroms. Instruments Division, North American Philips Co., Inc., 750 S. Fulton St., Mount Vernon, N.Y.

Circle No. **42** *on Reply Card*

Fluid Teflon

. . . as a thread sealing compound: a small bulletin on *T-Film* describes the many uses for this collodial dispersion of Teflon in water. Up to 600°F, this thread sealing and anti-seize compound will seal threaded joints subject to chemical corrosion. It also prevents galling and seizure of metal parts under these conditions. Eco Engineering Co., 12 New York Ave., Newark 1, N.J.

Circle No. **43** *on Reply Card*

Polyethylene Ware

. . . for the laboratory: *Bulletin P-965* is a 16-page catalog of laboratory equipment made from this unbreakable and chemically inert material. Covered are such items as bottles, beakers, test tubes, graduated cylinders, pails, pumps, funnels, etc. Scientific Glass Apparatus Co., Inc., Bloomfield, N.J.

Circle No. **44** *on Reply Card*

Did You Miss These?

The following items, reviewed originally in August, have aroused considerable interest among readers. They are repeated here briefly as a service to those who might have missed them the first time they appeared. For details or literature please use the regular Reply Card in this issue.

Microviscometer

. . . measures viscosity of asphalt under controlled conditions, and permits accurate predictions of life expectancy of asphalts.

A minute quantity of the asphalt to be tested is placed beween two polished glass plates, and a thin film is formed by pressing the plates together. One plate is moved across the other while the shear force is measured. After subjecting the specimen to aging processes the test is repeated.

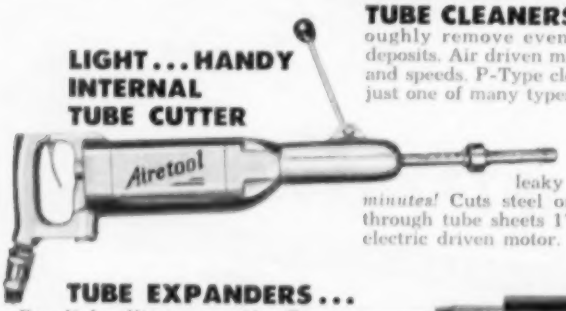
The results indicate the life expectancy of asphalts on ordinary pave-

toughest tube maintenance jobs are made easy with AIRETOOL equipment

See for yourself why so many refinery engineers specify AIRETOOL for their tube maintenance programs. AIRETOOL Equipment handles easy . . . is rugged, packs plenty of power and speed, won't bog down or break down during use. AIRETOOL does the *best* job, quickly, economically.

POWERFUL . . . FAST CUTTING TUBE CLEANERS quickly and thoroughly remove even hardest scale and deposits. Air driven motors in various sizes and speeds. P-Type cleaner head shown, is just one of many types available.

LIGHT . . . HANDY INTERNAL TUBE CUTTER



New . . . removes leaky or damaged tubes in *minutes!* Cuts steel or non-ferrous tubes through tube sheets 1" to 4" thick. Air or electric driven motor.

TUBE EXPANDERS . . .

Parallel rolling . . . self-feeding . . . AIRETOOL Tube Expanders roll tight, accurate tube joints with maximum bond, uniform expansion and tightness throughout full thickness of tube sheet.

Write for illustrated literature on AIRETOOL'S Tube Maintenance Equipment, or see your nearest Airetool Representative.

AIRETOOL
MANUFACTURING COMPANY
SPRINGFIELD, OHIO

BRANCH OFFICES: New York, Chicago, Tulsa, Philadelphia, Houston, Baton Rouge.
REPRESENTATIVES: in principal cities of U.S.A., Canada, Mexico, South America, England, Europe, Puerto Rico, Italy, Japan, Hawaii.
EUROPEAN PLANT: Vlaardingen, The Netherlands

TECHNIQUES *and* TOOLS

MAKE THE DIFFERENCE IN WESTERN HEAT EXCHANGERS

The manufacture of Western heat transfer equipment is characterized by two important factors: (1) employing the latest and best data available in establishing the actual needs of our customers quickly and accurately; (2) employing the same care and attention to detail in the fabrication of the equipment required.
Western Supply Company renders a *complete service* to each customer — research, design, engineering and fabrication — resulting in equipment of exceptional quality at a fair price, and built for long-life economy.
Your heat transfer requirements — present or future — deserve the attention of Western *specialists* in this field. We'll appreciate your inquiry.

In the *thermal rating* of heat transfer requirements, Western engineers have developed a technique which is actually a *consulting service,* working closely with customers to arrive at the best and simplest solution of their needs.

Thus, each Western exchanger is sized to give the most economical unit for the job, and reflects the experience gained in working equally closely with other customers with similar problems.

The Western "technique" also recognizes the importance of completing your heat exchanger file quickly, thereby allowing you to proceed with other operations.

For instance, when standard floating head, U-tube or fixed tube sheet exchangers are ordered from Western, you can depend on receiving drawings *within 7 to 10 days,* enabling you to proceed with piping and foundation drawings immediately.

In the fabricating stage, Western uses only the most modern production tools and equipment, assuring the utmost in production control in the building of your heat exchangers. Such quality controls as controlled torque tube rolling, weld x-ray, Magnafluxing and hydrostatic testing assure the consistent high standard of Western exchangers.

ASME code standards represent the *minimum* requirement for Western heat exchangers, but on *each* unit, Western builds the *best heat exchanger possible.*

Thus, in the instance of careful tube hole preparation and controlled torque tube rolling, a given Western Exchanger can be retubed more often for greater savings for our customers, because of these high standards of production.

Techniques and tools *do* make a difference in thermal and mechanical design — and the difference is in your favor at Western!

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HEAT EXCHANGERS

WESTERN SUPPLY COMPANY
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HUDSON-RUSH COMPANY — 753 Gladstone Blvd., Shreveport, La.
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P. O. Box 3151, Amarillo, Tex.

PROCESS INSTRUMENTS & EQUIPMENT CO. — North Bldg., Charleston, W. Va.

H. W. SEVERANCE — 2416 Frankfort Ave., Louisville, Ky.

NO.2 in a series of ALUMICOAT APPLICATIONS

PROCESS
PROTECTS
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More and more refineries are discovering the advantages of the new ALUMICOAT Process! ALUMICOAT offers a firm resistance against corrosive media — *especially sulphur compounds* — and extreme temperatures!

In the ALUMICOAT Process, refinery parts are dipped in molten aluminum to produce a metallurgical iron-aluminum bond at the interface and a surface overlay of pure aluminum. At temperatures exceeding the melting point of aluminum, the aluminum on the surface diffuses. This diffused coating, together with the iron-aluminum bond, provides a refractory material that gives steel maximum protection against high temperature scaling.

The Alumicoat Process can solve your corrosion and oxidation problems. Send for full details today!

ARTHUR TICKLE ENGINEERING WORKS, INC.
24 Delevan Street MAin 5-4200 Brooklyn, N. Y.

ments because the thin layer of tested asphalt is the same as the thin film that binds stones together in streets and roads. The instrument was developed at Shell Development Co. and is manufactured by Hallikainen Instruments, Berkeley, Calif. Further information is available from Shell Oil Co., 50 West 50th St., New York 20, N. Y.

Circle No. **45** *on Reply Card*

Hydraulic Fluid

. . . although made from petroleum does not burn on contact with flames, heated metal surfaces or molten metal. The oil is protected from burning by steam released from within the fluid.

This "snuffer" type hydraulic fluid is a special formulation of water, petroleum oil and emulsifying agents. The snuffing action by the released steam displaces oxygen from the immediate area. In most cases, the remainder of the hydraulic fluid will not support its own combustion.

Despite the water content, the fluid possesses all of the oil characteristics of proper hydraulic oil. It is noncorrosive on ferrous and most nonferrous metals, has a film strength for good anti-wear and anti-scuff protection, and high shear rate viscosities. A bright yellow coloring in the fluid results in instant recognition of the fluid. Shell Oil Co., 50 West 50th St., New York 22, N. Y.

Circle No. **46** *on Reply Card*

Cooling Towers

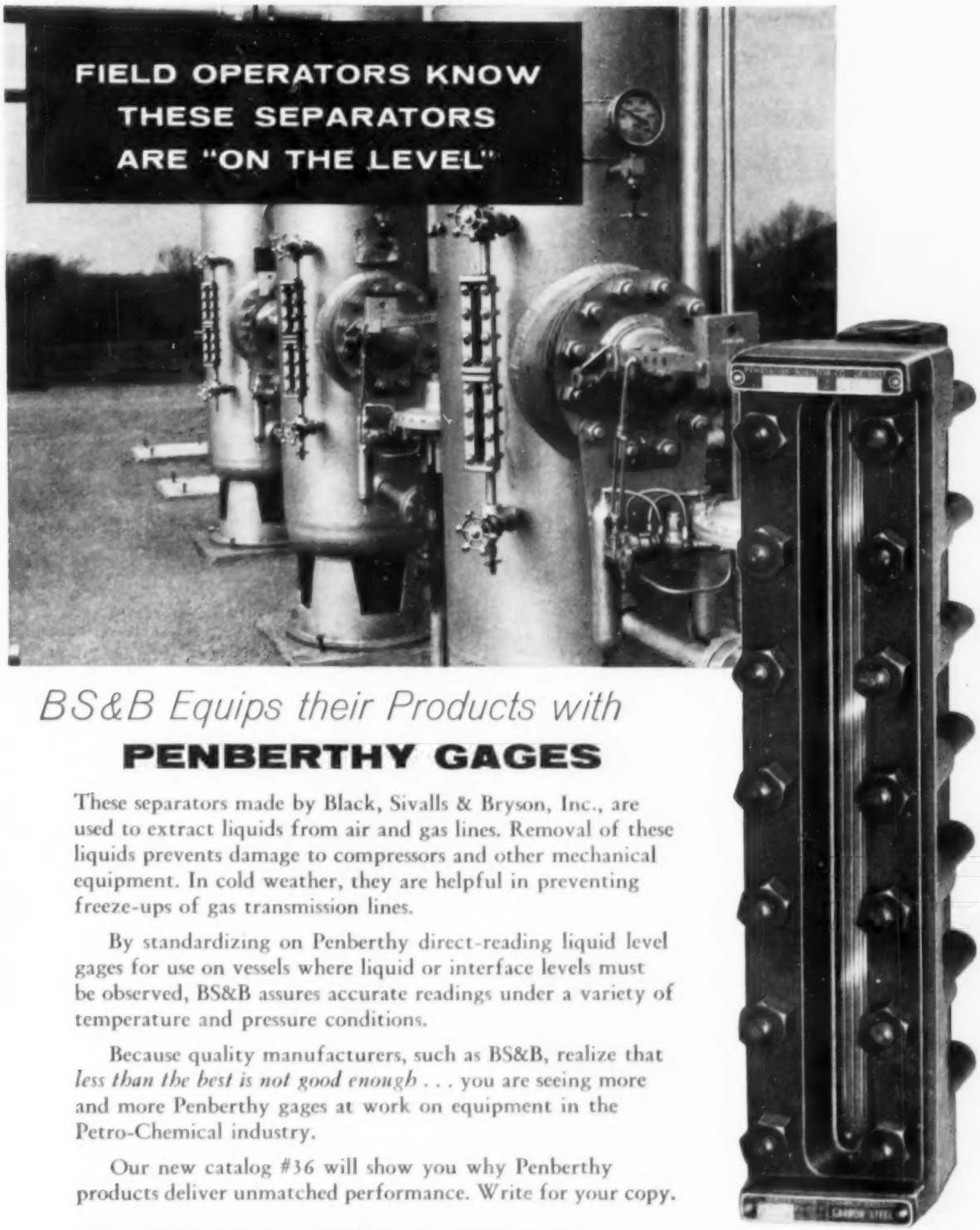
. . . from 10 to 400 tons capacity are described in 12-page catalog, *Bulletin 202*. Construction and design features are presented in text and pictures. Selection charts aid in picking units for air conditioning or refrigeration applications for any load conditions. Baltimore Aircoil Co., 2615 Mathews St., Baltimore, Md.

Circle No. **47** *on Reply Card*

Refining Processes

. . . their history and purposes: a 24-page booklet, *How Men of Science Help You Sell*, is a non-technical description of major refining processes. It begins with a simple explanation of octane number, how it is determined, and its relationship to modern high-compression engines. Differences among simple distillation, thermal cracking, fluid catalytic cracking, platinum catalysts, and reforming processes are summarized. This booklet is written for those who sell petro-

(To obtain more data on advertised products see page 114)



BS&B Equips their Products with

PENBERTHY GAGES

These separators made by Black, Sivalls & Bryson, Inc., are used to extract liquids from air and gas lines. Removal of these liquids prevents damage to compressors and other mechanical equipment. In cold weather, they are helpful in preventing freeze-ups of gas transmission lines.

By standardizing on Penberthy direct-reading liquid level gages for use on vessels where liquid or interface levels must be observed, BS&B assures accurate readings under a variety of temperature and pressure conditions.

Because quality manufacturers, such as BS&B, realize that *less than the best is not good enough* . . . you are seeing more and more Penberthy gages at work on equipment in the Petro-Chemical industry.

Our new catalog #36 will show you why Penberthy products deliver unmatched performance. Write for your copy.

PENBERTHY MANUFACTURING CO.

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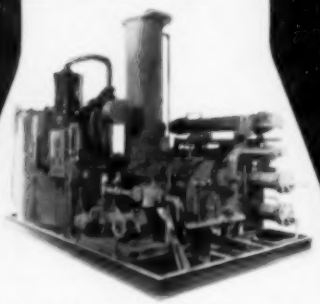
***There's Certain Satisfaction in* PRODUCTS BY PENBERTHY**

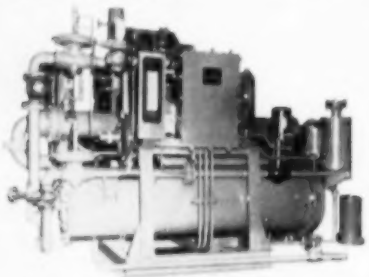
- EJECTORS
- INJECTORS
- CYCLING JET PUMPS
- ELECTRIC SUMP PUMPS
- LIQUID LEVEL GAGES
- GAGE VALVES

Gas Atmospheres is moving fast with Petrochemical Progress

Pace setting gas generation systems boost quality, safety in petrochemical production



Gas Atmospheres Hi-Purity Nitrogen Generators are available in capacities from 250 SCFH to 40,000 SCFH.



Gas Atmospheres Inert Gas Generators are available in single unit capacities from 250 SCFH to 150,000 SCFH.

No other generator manufacturer surpasses the ability and experience of Gas Atmospheres in producing complete systems for petrochemical processing. Gas Atmospheres Hi-Purity Nitrogen and Inert Systems are being used by most leading petrochemical processors for blanketing, purging or packaging such products as acetone, methanol, formaldehyde, acetaldehyde, butadiene, synthetic fibers, etc.

gas Atmospheres, inc

equipment for producing industrial gases

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leum products. Public Relations Dept., Universal Oil Products Co., 30 Algonquin Road, Des Plaines, Ill.

Circle No. **48** *on Reply Card*

Titanium

. . . and its use in combatting corrosion: *Design Away Corrosion with Titanium* is a bulletin that contains currently available data on the corrosion resistance of this metal. Many applications for overcoming corrosion through use of titanium are suggested. Included in the booklet is a table of the rating of titanium when exposed to many corrosive agents. Mallory-Sharon Titanium Corp., Niles, Ohio.

Circle No. **49** *on Reply Card*

Automatic Chromotograph

. . . analyzes the proportion of gases being upgraded in a processing unit at the Bayway refinery of Esso Standard Oil Co. The tailor-made unit is now on trial in Linden, N. J., and a second model is being prepared for service on another processing unit.

A steady flow of dry air propels samples of the gas through 20-ft columns packed with activated alumina. Emerging from the columns one after one, the components (mainly propane and propylene) move through a special detector. This consists of a small bed of activated carbon that heats up when the sample flows through. Measuring the heating effect and transmitting electric signals to a remote recorder permits graphic analysis of the refinery gases. Each component in the process stream is measured every half hour. The unit is the invention of physicist Charles W. Skarstrom of Esso Research and Engineering Co., 15 West 51st St., New York 19, N. Y.

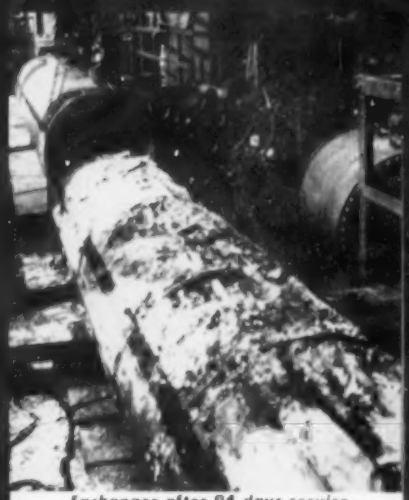
Circle No. **50** *on Reply Card*

Pipe Stresses

. . . are tabulated in *Technical Data Card 154A*. Designed for engineers, this booklet gives the maximum allowable stress values for ferrous pipe and tubing for elevated temperatures and pressures. Included are values for a complete range of seamless and welded carbon, alloy and stainless steel tubing. Formulas to be used in calculating maximum allowable working pressures are also included. Tubular Products Division, Babcock & Wilcox Co., 161 E. 42nd St., New York, N. Y.

Circle No. **51** *on Reply Card*

CORROSION FOULING SCALING AND HYDROGEN BLISTERING CAN BE STOPPED



Exchanger after 94 days service, before using Kontol

Same exchanger, after 117 days service, using Kontol

with KONTOL

Kontol corrosion preventives combat corrosive attack in distillation and other refinery systems. Kontol provides effective protection against attack by chlorides, sulfides, organic acids, and other destructive agents. In addition, Kontol acts as a powerful detergent to prevent scale accumulation and plugging.

For compete information, ask your Tretolite refinery service engineer, or write

TRETOLITE COMPANY

A DIVISION OF PETROLITE CORPORATION
369 Marshall Avenue, Saint Louis 19, Missouri
5515 Telegraph Road, Los Angeles 22, California
Petrolite Ltd., 120 Moorgate, London EC2, England

KR 569

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Chemicals and Services for the Petroleum Industry

Demulsifying, Desalting, Corrosion Preventing, Water De-Oiling, Paraffin Removal, Scale Preventing, Production Stimulating

EDITORIALS . . .

Refinery Yields Need Adjusting

EVER SINCE World War II, the demand for distillate fuel oil, chiefly for heating purposes, has grown at a faster rate than the demand for gasoline. Distillate demand has crept upward until today it is about 46% of gasoline demand; at the end of the war it was not quite 35%.

Output at refineries, however, is not keeping pace with this change in the demand pattern. From 1952 through 1956, gasoline demand is expected to be up about 20.8%, while gasoline output (refined from crude, plus natural gasoline blended) is gaining nearly 23.5%. As for distillates during this same period, demand is increasing 31.5%, while output is up only 28.3%.

This discrepancy in supply-demand rates for these two products has shown up in refineries' inventories. Gasoline stocks at refineries are expected to be at a record high of 186-million bbl by the end of this year. They will then be 33% greater than they were at the end of 1952. Obviously, because demand has gone up, stocks should rise correspondingly to maintain a proper supply-demand relationship. But remember that demand is up only 20.8% during the same period that stocks are up 33%.

Distillate fuel oil stocks, on the other hand, are expected to be about 122-million bbl at the end of the year, about 23% greater than at the end of 1952. The rate of increase here is more in line with the gain in demand—31.5%.

The heavy emphasis on gasoline output at refineries is reflected also in the trend in prices, particularly since the last general crude advance of 1953. In that year, after the readjustments in product prices that followed the crude advance, the price of gasoline averaged 12.01¢, that of distillate fuel oil 8.83¢. The differential to the refiner was 3.18¢. In nine months of 1956, the price of gasoline averaged 11.78¢, distillate fuel oil 9.41¢. Today the differential is only 2.37¢.

Reducing crude runs to stills to cut the output of gasoline and allow inventories to be liquidated to a realistic level is not the entire answer to the problem. The output of distillate fuel oil would also be reduced if this course were followed, even though stocks of this product are considered to be pretty well in line and demand shows good growth signs.

The answer would seem to be in a general adjustment of refinery yields, to cut the output of gasoline and increase that of distillates. Cutting the output of gasoline by only 50,000 b/d would make a difference of 18-million bbl yearly in total gasoline supply. At today's rate of crude runs, this reduction of gasoline output could be achieved by cutting yields only about 0.6%. A readjustment in distillate yields could economically compensate for the loss in gasoline output.

With wholesale prices for gasoline and distillate trending closer together, refiners now have a greater incentive to adjust their operations to bring about a more economic relationship between supply and demand of these two products

Absenteeism Can Be Licked

HOW LONG has it been since you've taken a closer look at the absenteeism record in your company? And if you have seen it recently, what kind of success have you had in reducing it?

Some intriguing facts about this problem and a workable approach were brought out by Leo Wade, medical director, Esso Standard Oil Co., in a paper at the 36th annual meeting of the American Petroleum Institute in Chicago last month.

One of the most important and helpful facts Dr. Wade learned from his company's records was that 50% of the time lost because of sickness absenteeism was attributable to only 5% of the employes. This meant that instead of a "shotgun" approach to the problem, Esso could concentrate its efforts on a relatively small part of the total personnel.

Esso used what might be termed a team approach. A group of management people met at fairly frequent intervals to discuss individual problem cases on a departmental basis and to decide a course of action. The team was composed of a member of top management, the employe relations manager, the supervisor or department head of the worker under consideration, and the plant physician and/or nurse.

Both the medical man and the worker's supervisor presented reports and comments on the worker. All factors that might have affected the worker's physical and mental condition were discussed by the committee. Alternate possibilities of "what to do about it" were also discussed. These included medical care, supervisory reprimand, or even dismissal. In any event, positive action was taken.

Did it work? Esso's records showed a decline immediately in costs at one plant where the plan went into operation in 1952. Expressed in terms of percent of payroll, the reduction in costs during a two-and-a half year period was about 25%.

The point to remember is this: Absenteeism is not an insurmountable problem. You should do something about it—and you can, if you'll deal with it realistically and at a management level.

DU PONT REG. U.S. PAT. OFF.

PETROLEUM CHEMICALS DIVISION

NEWS

DU PONT REG. U.S. PAT. OFF.

December ★ One of a Series of Bulletins for the Petroleum Industry ★ 1956

You can SEE the advantage of using ASHLESS Du Pont FOA-2

When you burn 1,000 gallons of home heating oil containing a dispersant additive, how much ash does the additive leave?

That depends on the additive—as the picture below clearly shows.

These bottles (8 fluid-ounce size) contain the amount of ash left from burning four different heating oil additives.

The bottle on the left contains practically *no* ash, although enough *non-metallic* Du Pont Fuel Oil Additive No. 2 (FOA-2) was burned to protect 1,000 gallons of fuel oil. (Actual concentration: 20 lbs./1,000 bbls.) The other bottles contain the ash left after burning cost-equivalent amounts of three metallic additives. The difference is so striking that comment seems superfluous.

Stack control failures

What damage do these ash deposits do in the burner system?

Many stack control failures can be attributed to metallic ash deposits on the helical coil. And such failures are likely to prove hazardous and result in needless, unprofitable service calls.

In rotary burners, metallic additives leave deposits on the flame rim and electrode. These tend to short out the electrode, causing ignition difficulties. And even if ignition is accomplished, the deposits on the rim will interfere with the progress of the flame around it.

In diesel fuels

When metallic additives are used to stabilize economy grade diesel fuels, there is a danger that these additives will contribute a sparking tendency to the fuel.

* * *

For more information about FOA-2, just address your request to our nearest sales office.

New dry-dye drumhead makes eduction faster and cleaner

Du Pont petroleum dyes are now being shipped in drums covered with newly designed steel drumheads, each having a 2-inch circular opening. Through this the dry-dye eduction probe can be easily inserted and manipulated.

NOTE HOW easily the dry-dye eduction probe can be inserted through the opening of this new-type Du Pont dye drumhead.

This opening is sealed with a plastic disc. When the dye is to be removed, the disc can be easily cut out with a penknife. (See cut on next page.)

The opening is rimmed with plastic which is threaded to accommodate a standard 2-inch pipe plug. That means easy re-sealing . . . to protect the quality which is built into all Du Pont dyes.

The new drumhead need not be removed. Using the small opening instead reduces dusting to an absolute minimum. When the eduction probe is inserted, little open space is left around it. Hence little, if any, dry dye will

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

DU PONT

PETROLEUM CHEMICALS DIVISION NEWS

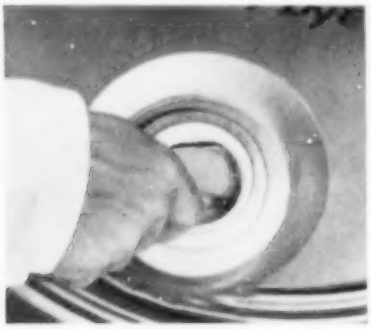
DU PONT

CONTINUED *New dye drum*

emerge, except as desired—through the probe itself.

Second recent improvement

The new drumhead follows by only six months another radical improvement in dry-dye eduction procedure—the new probe that is virtually clog-proof. More than 100 are now in service, and the demand for them continues.



FOR SHIPPING, the small opening is sealed with a plastic disc which can be easily cut out with a pocket knife.

Any of our sales offices listed below will be glad to give you complete information on the new dye drums and eduction probe. If you are not now using the dry-dye eduction system, our Operations Group will be glad to help you set up the complete installation.

A STANDARD 2-inch pipe plug keeps the dye drum tightly closed once the seal has been broken.

ASSISTANT MANAGER OF OPERATIONS

RUSSELL B. DAVIS has been attached to the Operations Group of the Du Pont Petroleum Chemicals Division since 1947. He currently supervises the work of this group, whose chief concern is to help refiners maintain safe, efficient handling of tetraethyl lead and other additives.

His contributions to safer TEL handling and more efficient plant operations in connection with the use of additives have been many. He played an important part in the development of such Du Pont-designed equipment as the metal-flex unloading hose, the siphon starter and the new, non-clogging dry-dye eduction probe.

After joining the Du Pont Company in 1933, his first assignment was in the Rayon Department. He was later transferred to the Engineering Department. From 1936 to 1947, he held a number of manufacturing positions in the Organic Chemicals Department, mostly connected with TEL manufacture.

Mr. Davis received his Mechanical Engineering degree from Rensselaer Polytechnic Institute. He is a member of the American Petroleum Institute, the National Safety Council and Sigma Xi Fraternity.

NEW DYE BOOK AVAILABLE

Gives detailed information on coloring all types of petroleum products

With the public becoming more and more color-conscious every day, refiners and marketers are putting increased emphasis on coloring all types of petroleum products.

Gasolines have been dyed for many years to indicate TEL content—also for brand identification. However, only recently have brilliantly hued greases, lubricating and home heating oils, kerosines and diesel fuels begun to appear. The merchandising advantages of using eye-appealing color for brand identification are no doubt an important reason for this trend.

To help refiners use petroleum dyes as effectively and economically as possible, we have just published a new manual on coloring petroleum products. All the latest methods of addition—including dry-dye eduction—are covered in this 20-page book.

It also contains data on meeting color requirements for military, aviation and leaded motor fuels. And full information on Du Pont Petroleum Dyes—with solubility charts and spectrophotometer curves—is included.

Just address your request for this book to one of our Petroleum Chemicals Division sales offices. Ask for a copy of "Du Pont Petroleum Dyes."

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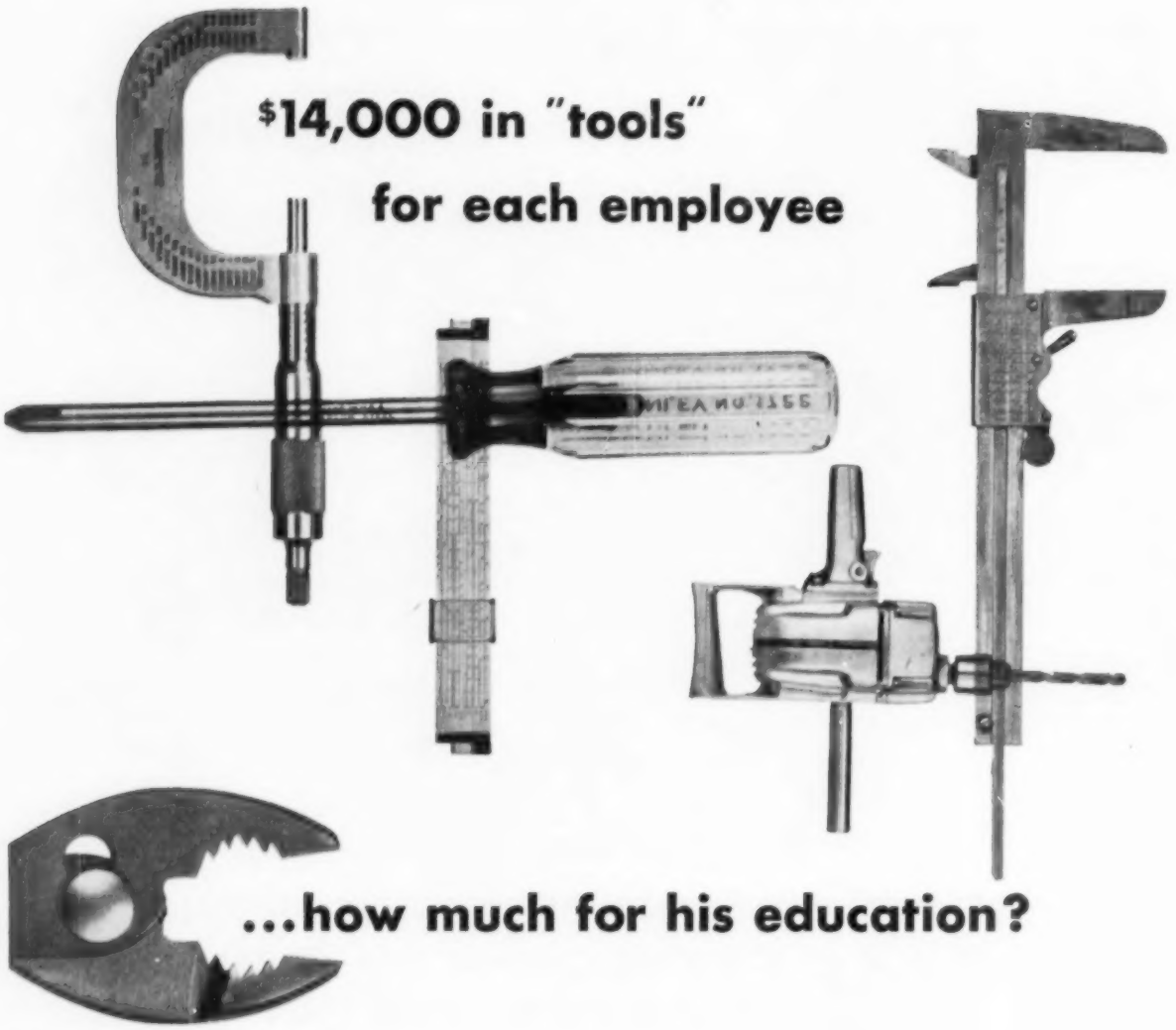

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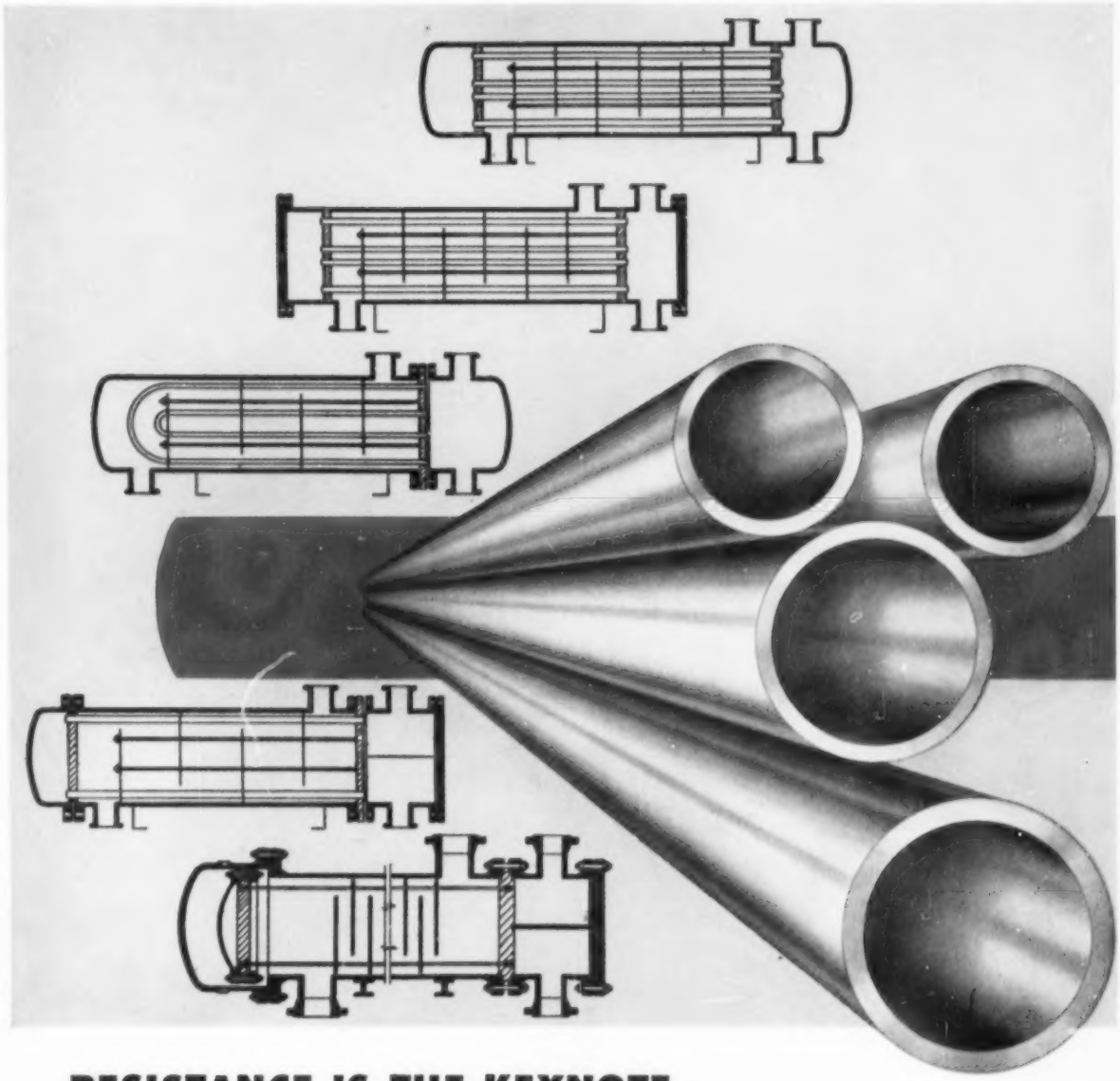

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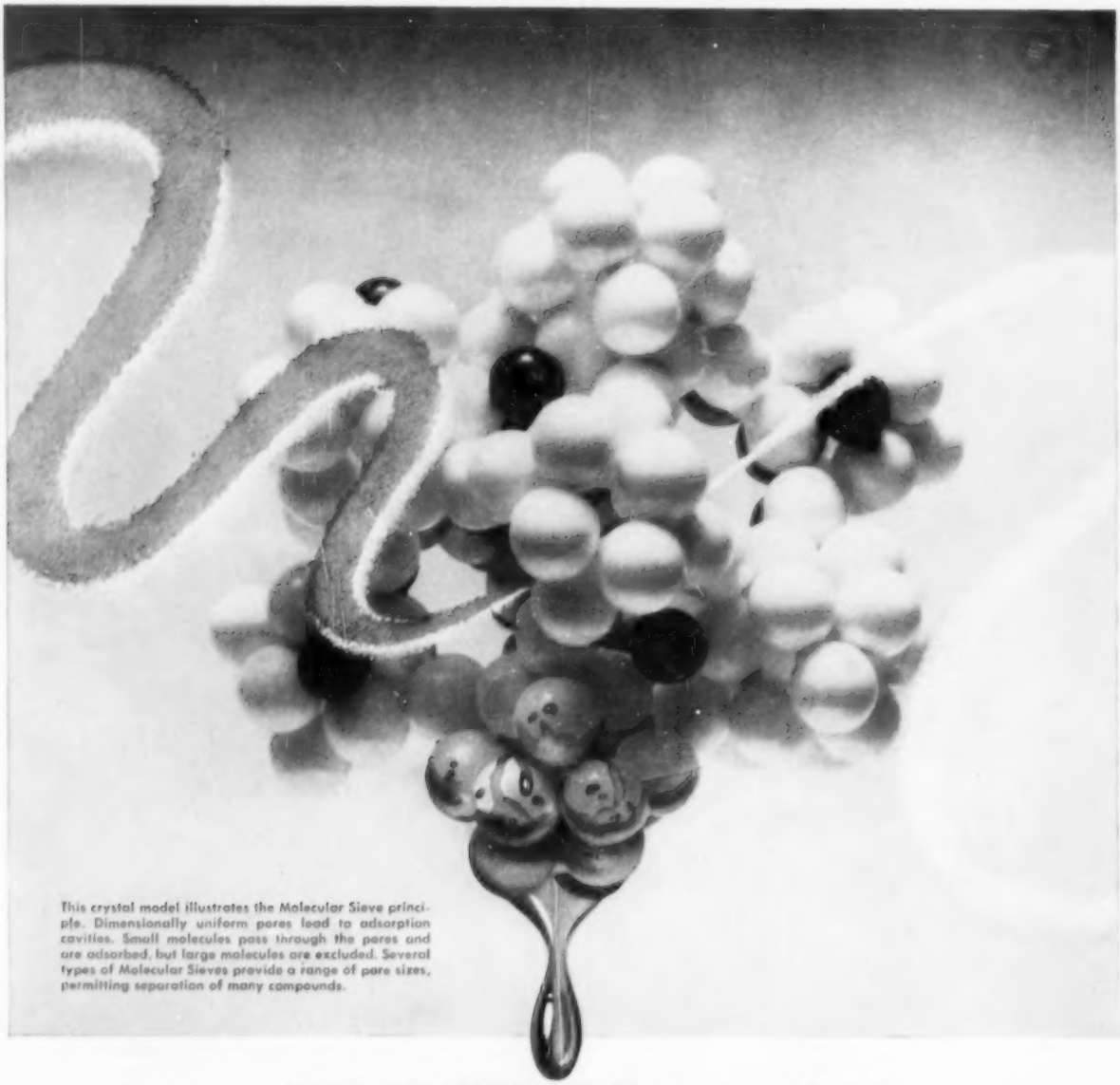

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THE INDEX

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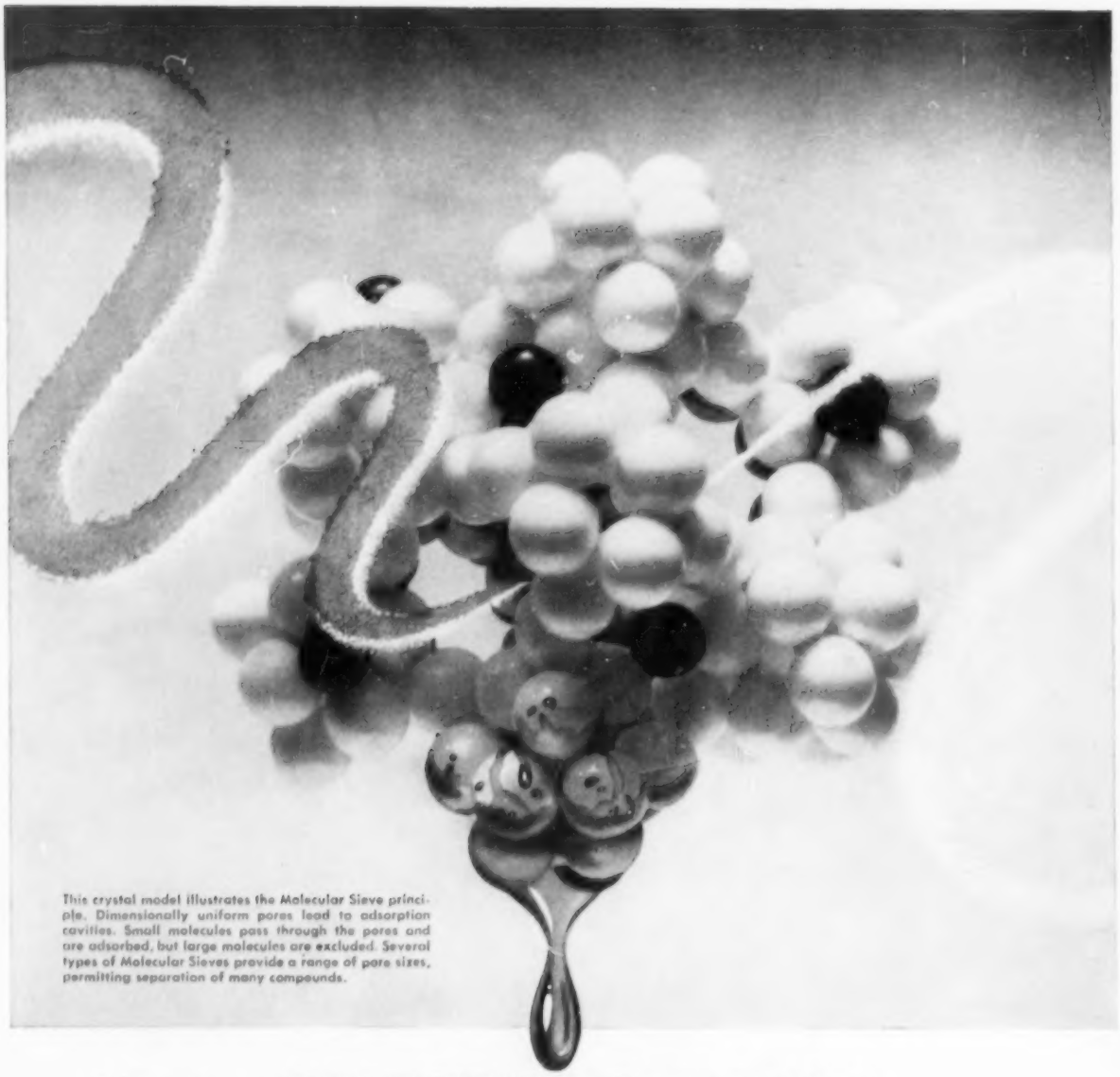

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